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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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Pause for Thought

IN the pause between the Government's decision to cancel Blue Streak as a missile, and the decision whether or not to continue its development as a space booster, there is much need for thought. The questions are endless, the problems immense.

Lord Hailsham's statement of the present position was that "We are undertaking close discussions with the industries and scientists concerned before we make up our mind." What this in fact means is that the Ministry of Aviation is discussing costs with de Havilland, Rolls-Royce and Sperry; the Royal Society's space-research committee is advising on the scientific advantages to be gained; the Government's Steering Group on Space Research is considering rather wider aspects of the subject, including effects on the industry generally; the Advisory Council on Scientific Policy, from its own rather loftier position, is weighing space projects against the demands of other branches of science; and departments such as the GPO and Air Ministry have doubtless expressed their own views on applied satellites for long-distance communications, meteorology and navigation. Side-effects concerning employment, and the stimulation of research and development in ancillary industries, are presumably also being considered. And finally, the Minister for Science will endeavour to make an overall recommendation to the Cabinet, who have to take the ultimate decision.

There is little point in repeating here the many arguments for a space research programme which have been canvassed in recent months, although it is fair to comment that most of these arguments have been mere parrot-like repetitions of particular campaigns sponsored by particular groups. While these statements are perfectly valid as facts or opinions—essential inputs of information to the main problem—they are *not* valid in themselves as statements of the complete picture or as solutions to the problem. Few people now doubt what can be done, and few now doubt the eventual benefits; but the all-important factor is that of motive.

The Danger of Prestige

For this country to embark on practical space efforts, the international co-operation hinted at earlier this month by Mr Sandys is not merely advisable. It is essential. A comment made by Lord Rea in another context, but which is exactly appropriate here, concerned the divergence of opinion between "those who see this country in the continuing historic role of a great individual and insular sovereignty, and those who, less romantically but more realistically, see that the present world and the future world can exist only on reciprocity and on the considerable abandonment of old barriers, and of old exclusions, and of old prides and vanities and prejudices, and prestige. The dream of this country continuing to enjoy the sort of position which it enjoyed in the last century is a nostalgic dream and, therefore, a very dangerous one."

International co-operation rather than national prestige should be the first aim. The second main point at this time concerns the seriousness of the forthcoming decision. May the members of the Government ignore the impatient proddings of political opponents (and supporters), industry groups and space enthusiasts (and opponents) who are demanding an immediate answer. May they take all the time, and advice, that they need to come to a balanced decision on this. The result must be a logical philosophy embracing science, defence, commerce and industry. This is one of the most difficult national problems of our time, and we cannot afford to make a mistake.

FROM ALL QUARTERS

BAC Chairman: Lord Portal

CHAIRMAN of the British Aircraft Corporation, the company formed by Vickers, English Electric and Bristol, is to be Marshal of the Royal Air Force Viscount Portal of Hungerford. In an announcement last Monday night the other members of the board were also named; they include Maj-Gen Sir Charles Dunphie and the Hon George Nelson (English Electric's present managing director) as deputy chairmen.

At the same time it was announced that negotiations have been completed whereby BAC will acquire a controlling interest in Hunting Aircraft Ltd, which will now become an operating subsidiary of the corporation.

Also made known was the reconstitution of the English Electric Aviation and Vickers-Armstrongs (Aircraft) boards. Lord Nelson of Stafford retires from the chairmanship of the former and his son is to succeed him. The appointments will be given in full in our next issue.

Airborne Yeomanry

FOR the whole of last week, from 1727hr on May 14 to 0400hr on May 23, RAF Fighter Command was in a state of readiness for the annual UK air defence exercise, this year code-named "Yeoman." The exercise itself took place in a three-day period starting at midnight on May 18; and in a summing-up communiqué last Monday the Air Ministry said that never before had Fighter Command "imposed upon itself such a severe test for so long a period."

In his preliminary briefing on "Yeoman" the AOC-in-C, Air Marshal Sir Hector McGregor, made it clear that the exercise had been planned within the context of a manned-bomber threat. He said that while the ballistic missile threat was mounting, it was not the major one today. The exercise had four main aspects: obtaining a realistic measurement of the time taken for Fighter Command to reach 100 per cent readiness; testing the effectiveness of the control system and improving tactics developed in the face of intense electronic jamming; and testing both the resilience of the air defence system and co-ordination between manned fighters and SAGW systems. The final communiqué said that the high level of jamming had proved "a most useful test"; the resilience of the defence system had been "thoroughly tested"; and co-ordination between fighters and SAGW systems had been excellent.

During "Yeoman," Firestreak—carried by Javelins—was used for the first time in a defence exercise. The aircraft reported a satisfactory rate of interception. Lightnings were also deployed, as part of their tactical and technical trials. Attackers included RAF Valiants, Vulcans, Victors and Canberras; USAF B-66s and F-100s; RCAF CF-100s; and French Air Force Vautours.

The crews of two Javelins of No 29 Sqn had a remarkable escape when their aircraft collided. Successful ejections were made and one crew was spotted in the sea some 40 miles off the Durham coast by a Shackleton of No 42 Sqn on standing patrol. It directed a helicopter to the rescue. The other crew came down safely in the Durham countryside.

More About the H.P.115

ON May 19 Handley Page Ltd issued the following statement: "An important aspect of very fast aircraft is their behaviour at low speeds. This cannot be anticipated satisfactorily by theoretical or tunnel-testing methods alone. Handley Page is therefore building—under Ministry of Aviation contract—a small research aeroplane so that low-speed investigation can be carried out in the air. This single-seat aircraft—the H.P.115—will fly this year. It has a slender, low-aspect-ratio delta wing and is powered by a small jet engine [Bristol Siddeley Viper—Ed]. It will be flown to study stability, control and handling characteristics in order to assess the performance to be expected from aeroplanes of this layout during take-off, approach and landing."

On the previous day the company also made an announcement of their work in the design of supersonic transport aircraft. They pointed out that they have played a considerable part in the British national effort in this field and that a wide series of design studies has yielded much information. During investigation into designs with cruising speeds of up to M3 a variety of new techniques—such as flexible tunnel models—has helped to determine flutter speeds and improve research into stability and control. The company's own tunnels have been used during work on slender deltas, in order to determine the best location for intakes and control surfaces, and new models in which pressure-distribution over the entire surface is carefully considered will shortly be tested.

Royal Flush V

FOR the first time since the initial AIRCENT Reconnaissance Competition was held (in 1956), the main award—the Gruenther Trophy—was won by the 4th Allied Tactical Air Force when the 1960 contest, Royal Flush V, was held at Bremgarten in Germany last week. This year, for the first time, night reconnaissance was included; and the winners were RB-66s of the USAF 10th Tactical Reconnaissance Wing, based at RAF Alconbury, who scored 2,988 points against 2,258 by Canberra PR.7s from RAF Germany. The daylight competitions were for short-, medium- and long-range aircraft, and the overall scores were 20,851 points for 4th ATAF and 19,980 for 2nd ATAF. French Air Force aircraft were teamed with USAF machines on the 4th ATAF side, and aircraft of the Belgian and Dutch Air Forces and the RAF represented 2nd ATAF.

U-2—American View

ON May 6 a Lockheed U-2 was displayed at Edwards AFB. Number 55-5741, it was all-black, with "NASA" stencilled on the vertical tail. The skin appeared very thin. Though the latest U-2s (including that lost over Russia) have a J75-P-13 engine, this specimen had a special J57. Finish was superb; the control surfaces fitted with a gap of under 0.1in. There was no ventral fin, but the tip of each wing was turned down to form an end-plate and skid.

At take-off the aircraft rides on a twin-wheel braked unit near the c.g., a small rear-fuselage gear and jettisonable outriggers under the wings; the three subsidiary units each have a pair of very small wheels with solid tyres. Special low-volatility fuel is carried in fuselage and wings (some U-2s have pinion-type wing tanks) and the radar and cameras are in the nose. The canopy

DEFENSIVE FRONT LINE: Lightning, Hunter, Javelin—types of Fighter Command aircraft taking part in Exercise "Yeoman." The Lightning is still being evaluated; the Javelin carries DH Firestreaks

HIGH-SKY SPY: This is the Lockheed U-2, which was exhibited at Edwards AFB on May 6, parked outside the NASA Flight Research Department. It is commented upon in a news-item above

MUFFLED: At Prestwick, where Scottish Aviation overhaul CF-100s and Sabres, this new duplex ground-running silencer is in use. Designed by Industrial Acoustics Co Ltd, it is fabricated by Burnley Aircraft Products Ltd. Further details will appear next week

SEEN AT BLACKBUSHE on its way from Ottawa to the Seychelles to undertake a survey of the whole group of islands is a Grumman Mallard of Spartan Air Services Ltd. Bristol Aero Industries Ltd installed the special equipment. Here with the crew (Capt Taylor, V. Kluke and D. H. Frederics) are (l. to r.) Lord Waterpark, Spartan's European manager; H. A. Stamers Smith, Director (Air), Directorate of Overseas Surveys; and E. E. Barnes, Spartan's London manager

roof is white, and the pilot has a pylon-mounted mirror and a ventral periscopic sight for the panoramic camera system. A closed hemisphere ahead of the cockpit on 55-5741 appears to contain a star-tracker. A correspondent writes that pilots wear a partial-pressure suit and start breathing oxygen two hours before take-off. He suggests the story that the Sverdlovsk aircraft could not have been destroyed by a missile be discounted. Nevertheless *Aviation Week* says, "The fact is . . . that Powers' U-2 had an engine flameout at the altitude that it and other U-2 aircraft cruise safely beyond the reach of the Soviet air defense system . . . the aircraft had descended to about 37,000ft attempting an engine restart. . . ."

Among U-2 wreckage displayed in Moscow the electromagnetic receiver for monitoring and recording radio and radar transmissions from the ground was battered, but the makers were named as Huggins Laboratories, Hewlett-Packard and Raytheon, and the wavebands as micro, decimetric and meter. There was a Lear A-10 autopilot and MA-1 compass, Bendix ARN-6 ADF and Magnavox ARC-34 UHF command radio. The principal camera was a Model 73B, though the usual panoramic camera appears to be the Perkin-Elmer 501.

Data for early U-2s published in *Aviation Week*, quoting the makers, are: span, 80ft; length, 49ft 7in; gross weight with 785 US gal fuel, 15,850lb; gross weight with pinion tanks and 995 US gal, 17,270lb; range, 2,200 miles (2,600 with pinion tanks) with 100 US gal reserve; cruising speed, 460 m.p.h.

Change in Orbit

A RETRO-ROCKET fault, which caused the "spaceship" capsule of the Soviet satellite launched on May 15 to be accelerated instead of decelerated after separation, was announced by the news agency Tass on May 20. The following are passages from the official statement:—

"On May 19 the Sputnik spaceship completed its programme of observations. At 0252hr an order was sent to the ship to switch on its braking device in order to deflect it from its orbit, and to detach the pressurized cabin. The device went into operation and the ship, as planned, was stabilized during the firing of the retro-rocket.

"However, as a result of a fault which had developed in one of the instruments of the orientation system, the direction of the retro-rocket's blast deviated from that planned and the speed of the spaceship, instead of being reduced, increased slightly and the ship slipped into a new elliptical orbit, lying in almost the same plane but having a much higher apogee.

"The detachment of the pressurized cabin has been effected and normal work of the cabin's stabilization system has been registered. A number of highly important scientific and technical problems have been solved. Reliable control of the satellite in flight and its orientation have been effected for several days. Telemetrical measurements obtained show that the system of conditioning and heat regulation functioned normally throughout the flight and ensured conditions necessary for future manned flights.

"Telegraphic communication with the space ship was normal. Telephoned rebroadcasting of broadcasts of ground radio stations through the spaceship's equipment involved noise with marked distortions. The self-orienting solar batteries functioned normally.

"The spaceship and the pressurized cabin in its vicinity are now moving along an orbit with its lowest point at 307km (about 191 miles) and its highest at 690km (about 429 miles) with a transit time of 94.25min. The angle of the orbit's inclination to the equatorial plane is 65°. The final stage of the carrier rocket continues in its earlier orbit. The spaceship's signal radio-transmitter continues the work of the systems and instruments."

IN BRIEF

The Royal Society of Arts has awarded its Gold Medal for 1960 to Sir Frederick Handley Page "for leadership in the design and manufacture of aircraft." This annual award was instituted in 1864.

A Valiant of No 214 Sqn, Bomber Command, was due to fly non-stop from Marham, Norfolk, to Singapore last Wednesday, covering the distance of 8,110 miles in just over 16hr and being air-refuelled twice.

For the first time, a European company is to receive the Lawrence Bell Helicopter Pioneer Award, presented annually by Bell Helicopter Corporation. Thus honoured are Fison-Airwork, in recognition of their "pioneering work and continuous helicopter operations over the past decade and more."

Tomorrow, May 28, the British team for the World Gliding Championships leaves this country for Butzweiler Airfield, Cologne, where the championships begin on June 4. Captained by Mrs. Ann Welch, the pilots comprise Nicholas Goodhart (Olympia 419), Anthony Deane-Drummond (Skylark 3f) and Anthony Goodhart (Skylark 2b).

The twice-postponed 9,000-mile Atlas ICBM mission was finally made from Cape Canaveral on May 20. The missile was airborne for 52min, the nosecone impacting—with an "encouraging" accuracy—1,000 miles SE of Capetown and about 500 miles NE of the Prince Edward Islands; the track was entirely over international waters. Payload was that of an operational Atlas; additional range was achieved by allowing the tanks to run dry and selecting a higher trajectory.

HONOURS AND AWARDS for RAeS members were presented on the evening of the Wilbur Wright Lecture (details, page 675 of "Flight" last week). Receiving them from Dr E. S. Moult, the president, are (right to left) Prof W. J. Duncan and Sir George Edwards, Hon Fellowships; Sir Frederick Handley Page, Gold Medal; R. H. Chaplin, Silver Medal; H. G. R. Robinson, Bronze Medal; B. E. Stephenson, British Gold Medal; E. G. Broadbent, Wakefield Gold Medal; and Wg Cdr R. P. Beamont, R. P. Alston Medal. Absent were P. A. Wills, C. J. Wood and J. A. Miller

Short-field Day at Shoreham

A FLYING CONTEST WON ON THE GROUND

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

Helio high jump: M. D. Parry Western rolls the 10ft tape in Autair's Courier. He won the Kemsley Challenge Trophy and the Osram Cup

FOR the competitors in the Royal Aero Club's Business and Touring Aircraft Competition at Shoreham last weekend the most difficult part was getting to the start. A heavy post-Summit depression had settled over Northern France on the preceding Wednesday, and by the time the competition was over it had scarcely moved.

On Thursday afternoon at 4 o'clock, the official "last reporting time," only seven of the competitors had checked in at Shoreham, although Flt Lt Austin's TriPacer was in the circuit. From Boscombe, from Kidlington, from Thruxton and from Samlesbury respectively, Parry's Helio Courier, "Toss" Murray's Super Cub, the Jackaroo and Rutter's Prospector had squeezed in between cloudbase and hills; Peter Masefield slipped in on QDMs from Shoreham and Gatwick; the TriPacer and Smith's Comanche made it from Kidlington; and *Flight's* Gemini nipped through the Guildford gap and into the better weather south of that escarpment. Later, with the coastal weather closing in again, the Meta-Sokol, Tipsy Trainer and Gregory's Taylorcraft brought the total number of Thursday's arrivals to eleven.

Eleven in out of 45 and the outlook for the first contest day very little better! Clearly, plans would have to be changed, and the RAeC stewards accordingly decided to reverse the order of the competition and postpone the touring part until Saturday. Hopefully, time-of-arrival was put back to nine a.m. on Thursday, but by then only one more competitor had arrived. This was the royal entry, the Garland Linnet entered by the Duke of Edinburgh and flown by John Severne. Less than two days before it had been almost completely stripped and was a scene of frantic activity at Fair Oaks; after all-night work and a 5 a.m. start on Friday it was completed, test flown and brought successfully down to Shoreham.

Elsewhere, competitors stared gloomily out at the weather, looking for the break that would make a take-off possible; if control zones and hills could be circumnavigated, the ceiling at Shoreham was 600ft and visibility relatively generous. One by one new arrivals came in, some flying contact, others—better equipped—making good use of Shoreham's traffic control at Shoreham, which was completely and super-efficiently on the ball.

Other controllers, too, merited thanks and praise. A telephone call to Gatwick and *Flight's* second entry, the Maitland Drewery Super Aero, was promised radar-monitoring through the zone. At 75ft above Biggin Hill the Super Aero stuck its nose into cloud, turned on to a timed leg for the coast and was reassuringly held in radar contact. Brief transmissions were sufficient for Shoreham's manual VDF to crack back with homing QDMs to bring the aircraft right overhead. Then a let-down over the sea, a turn on to the reciprocal and there were the familiar Shoreham landmarks of the power station on the coast and Lancing College up on the hill.

That was the seventh arrival of the morning and the Aztec, Peter Brook's Chipmunk and Cash's Messenger followed not long afterwards. Last arrivals of the day were Gray's Proctor 5 and Jackson's beautifully restored Miles Monarch. That made a total of 27 arrivals out of a possible 45; all things considered, not a bad score.

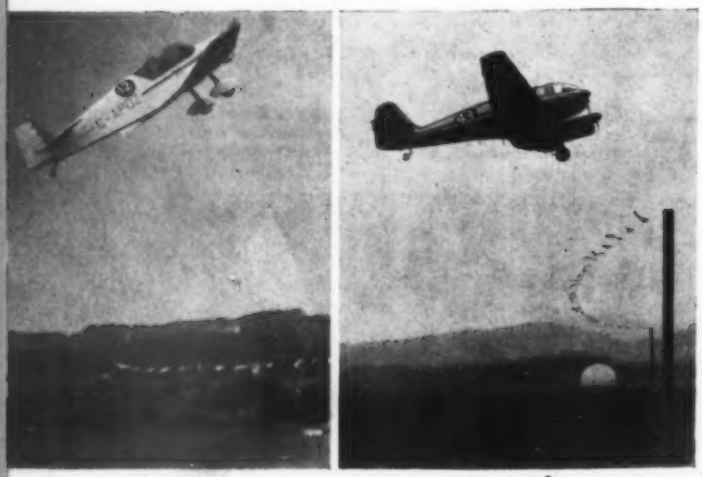
By mid-morning a line of aircraft were waiting, fuelled to the eyebrows, to tackle the short take-off and landing that comprised the sole flying part of the first day's events. In practice, this was the sum of all the flying—less than five minutes per aircraft—in the whole tournament. The weather put paid to any attempt to hold the touring competition on the following day and the results were decided largely on performance on the ground.

For the take-off test, pilots had to declare beforehand the distance in which they thought they could clear a line strung 10ft high between two poles, and then back their verbal judgment with a run at full fuel load. Order was decided by ballot—two ballots in point of fact, because by the time that the first one was drawn, other aircraft arrived and the first was no longer complete. Another draw was made and for the second time Heaton's name was the first to come out of the hat. He made his declared distance and won the first marks—235, awarded at one mark for every two yards of declared take-off run subtracted from the maximum of 300.

To competitors lined-up and ready to go, the string with its fluttering pennants looked horrifyingly close. The wind was slight and the grass, though freshly mown, was thoroughly wet. Practically no one had been able to practise at Shoreham, so that chances were all more or less equal. Nevertheless, some of the declared distances looked almost impossibly close: 75 yards for a Super Cub, another well under a hundred for the Lancashire Prospector and 130 yards for the Jackaroo. The larger of the two Jodels—the D.140 Mousquetaire—had been declared by Francis to have a take-off distance 20 yards less than its smaller brother the D.117 and, at 150 yards, made it safely. By contrast, Peter Masefield added five per cent for the wet grass to the practice 220yd distances that he had achieved with his Chipmunk on concrete and found it was not enough. Short of speed, he slipped under the string.

Most spectacular take-off in Class I was that of the Piper Super Cub, the Vigors Aviation entry for that class. From 75yd the 150 h.p. Cub simply leapt into the air, tailwheel dragging, and cleared the 10ft line at a quite extraordinary angle.

Much the most spectacular take-off of all was that of the Helio Courier. Approaching the barrier from 90yd, Parry found the bunting shaking in a gust (an allowance had been made for the effect of wind in bowing the string) and heaved the Courier upwards, sideways and over in a sort of aeronautical Western roll. Ken Rutter had set himself too optimistic a target with the Prospector and went through the string. So did unfortunate Bob McIntosh, the flaps of whose Cessna 175 tripped-off and retracted themselves during his take-off run. By the time that he noticed, it was already too late and he had no option but to go under the



Left: hand hard on the throttle, D. McDonell Hortas leans forward against the straining climb of the Rollason Jodel D.117. Right: comfortably clear is Mark Lambert in the Aero 45, recently repainted for owners' Maitland Drewery in striking yellow and black. This was "Flight's" second entry

Collecting prizes from Air Cdre A. H. Wheeler for the most comfortable, well-equipped, capacious, easy-to-start and best short-field aeroplanes are, left to right above, M. D. Parry (winner overall and winner class 2); Wg Cdr T. C. Murray (winner class 1 and proxy for Wg Cdr T. A. Vigors, winner class 3). Below, l to r, Sqn Ldr J. Severne (second place class 1) and Maurice Smith (winner, aircraft registered before 1950 and second place class 3). Second place in class 2 was gained by R. A. Smith

bunting. Cash (Messenger) was another to hit the tape on take-off, and Gray's Proctor 1 also just failed to make it. Joe Taylor's Proctor 5, on the other hand, cleared the line quite easily, but the Proctor's run was 375yd and so longer by 75yd than any others that day.

Class 3 came to the line sadly depleted. None of the three new 2×140 h.p. Aero 145s had been able to get over from the Continent and there was no Cessna 310 to do battle with the Aztec, or Apache to take on the Super Aeros. *Flight's* Gemini was the sole British aircraft entered in the class.

The shortest take-off run was declared, and made, by the second heaviest aircraft, Tim Vigor's Piper Aztec. The Gemini took 20yd more and could have reduced it, though not down to the Aztec's 200yd, and the Piaggio's 300yd appeared to be well-judged. Mark Lambert had some yards to spare taking off in the Super Aero. A respray in Maitland Drewery's new yellow and black colours, a check, and some horrid weather had conspired to make this only his fourth take-off.

Last attempts of the day were by Joe Taylor, who had to change the plugs in his Proctor 1, and N. A. L. Thorne's Auster V. The latter was granted a second attempt after being balked.

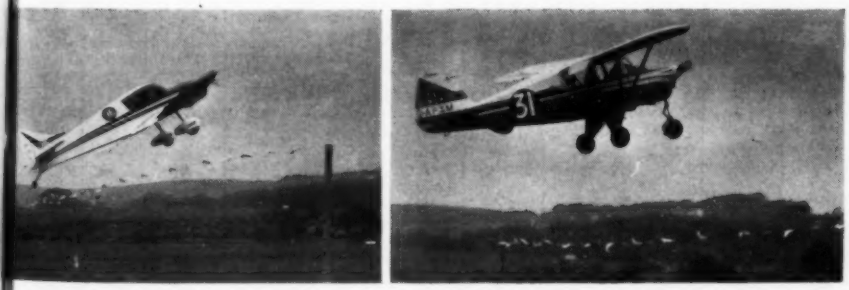
Immediately following each short take-off came a half-circuit around to the short landing, to be made across a white line set a comfortable distance in from the hedge and on to a 150ft-wide strip delineated by a series of small balloons. This test was one of pure flying skill and the general standard was high. Marks were deducted from 300 at the rate of one for each two yards of landing run, so that not only accurate judgment but a low landing speed and good brakes were a prerequisite of a good score.

Particularly good were Murray (57yd), Beverley Snook (87yd) and John Severne (98yd); the Jodel D.117 landed tailwheel first, Hodgson's Tipsy Trainer dropped short and the blue Monarch landed well over the line. On his second shot, Thorne was nearly balked by a visiting Gemini; things didn't seem to be going his way and he landed short. One or two competitors had trouble keeping straight, among them Peter Masefield and the Earl of Derby's Piaggio, flown by D. B. Cartlidge, which swung well away to port. On the approach the P.166 had streamed great quantities of fuel from the vents in the starboard wing.

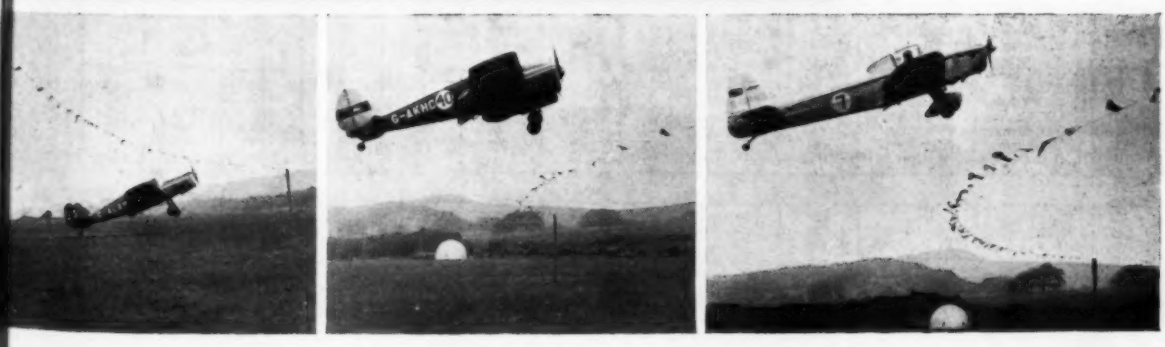
Again it was the Proctors that brought up the tail on landing performance, Gray coming to rest in 250yd. This exceeded the next longest run—that of the Piper Aztec—by some six yards, but Tim Vigor's was complaining of locking brakes on the slithery grass. This allowed the Gemini to nip comfortably ahead on total marks for take-off and landing combined. Similarly, the Taylorcraft slipped past the Jodel D.117 and the Monarch landed 67yd shorter than the Comanche.

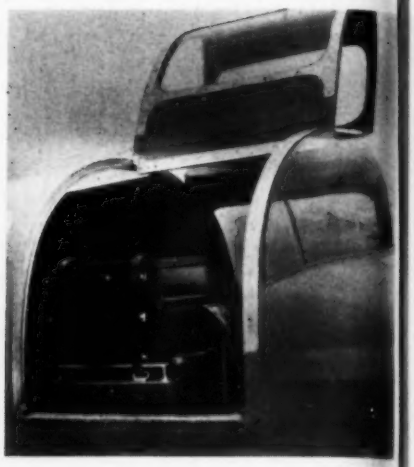
Because of the late start, the engine starting test had been scrubbed early on and it was also decided to abandon the rather contrived manœuvrability test. There were mixed feelings about this, because there had been some successful if expensive practice earlier on. But the *concours d'elegance* was held as planned, and judged by Air Cdre Allen Wheeler, Ian Forbes and Pat Fillingham. For this 700 marks were awarded; 200 for comfort and convenience, 300 for general condition and flight operating equipment fitted and 200 for baggage space. In assessing comfort and convenience, the judges looked at ease of entry for pilot, passengers and baggage, the view, and the comfort of the seats.

When all the judges had climbed in they examined for convenience and positioning fuel cocks, flap and undercarriage controls and indicators, trims, brakes, starters, and cabin heating and ventilation; and then they looked around for map cases and the manner in which notices and instructions were positioned. "General condition" included paintwork and trimmings and "flight operating equipment" gave marks for a full blind-flying panel, other instruments, and night flying equipment; and there were some bonus marks for additional good equipment. A loudspeaker carried more points than did headphones and full airways radio was worth a substantial margin of points. Then there were the details: folding wings, adjustable rudder pedals, ashtrays, rear-cabin heating and so on, each of which was worth extra marks. While the aircraft were being judged on equipment and beauty, a surveyor was measuring their baggage holds, no account being taken on this occasion of restrictions on all-up weight. This part might be termed the *concours d'intelligence*, as there were various arrangements that could be made for extending baggage-hold capacity. Some neatly shaped suitcases were in evidence here and there and the jumbo-size locker in the Jodel D.140 (which can



Crossing the line at Shoreham are, top left and right, Jodel D.140 (C. P. Francis) and TriPacer "Mother's Blessing" (Flt Lt P. Austin); below, left to right, Messenger (P. B. Cash), Gemini (Maurice Smith) and Linnet (Sqn Ldr John Severne). Yes, the Messenger failed to make it





Murray makes a run for it. Easy-starting the Super Cub: open port window, release starboard door catch, run round to starboard side, leap in, switch on fuel, magnetos and master switch, press starter; time, 12sec. (Right) Weekend at Le Touquet, or further afield? Neat presentation of baggage by Jackson and the Monarch in the concours d'elegance

SHORT-FIELD DAY AT SHOREHAM . . .

accommodate a stretcher) was explained as being "only part of the accommodation—room for more up front." Best of all was the Piaggio, the only aircraft to get full marks in any test.

So to the next day, Saturday, and—if all had gone well—the touring competition. But it was drizzling again and the cloud was on the downs. On to the day's most important document, the weather forecast, the met. officer had written facetiously, "The rain it raineth every day and even my garden has had enough." Competitors certainly had had enough, for without the touring test as a way of finding the best business and touring aircraft the competition would be meaningless. For a while it seemed as if it might be possible to try again the following day, but administrative difficulties intervened and instead the starting test was revived as seaside entertainment for the Saturday.

Last week we wrote that, running from a wing tip, opening a door or canopy, switching on and getting started could probably be completed in around ten seconds. At Shoreham two contestants, John Severne and J. O. Hodgson, respectively started the Linnet and canopied Tipsy Trainer in five. Margo McKellar wound up the Hornet Moth in seven seconds, Gray started his Proctor in six and Parry the Courier in seven. Hartas, Heaton (on a handswing) and Austin were quick too with eight seconds and five other entrants were running within nine. Some performances were quite extraordinarily good: Murray had to run to the port side of his Super Cub, lean through the window and release the doors before ducking under the nose and clambering in on the starboard side. He did this in 12sec, and the Super Cub isn't the easiest of cockpits to get into. *Flight*'s Gemini was the first twin to be started and Maurice Smith raised a special cheer by using both starters at once to record nine seconds. Cartlidge, the Piaggio pilot, had an easy door to get into, but then had to run all the way up the cabin and select fuel and ignition from overhead switches. He was careful to close the door before he did so.

And there the competition had to end. The outright winner was Parry and the Helio Courier, and in the other two classes the Super Cub and the Aztec. In the absence of the Cessnas these were, perhaps, almost predictable results on the tests that could be held. There were discrepancies, it is true: how else could the Aztec show less baggage space than the Super Cub? It was damp but not dispiriting, and the Club sportingly returned half the entrance fees to all who took part and awarded half the prize money. So the best business and touring aircraft has yet to be found; that will have to wait until the repeat next year.

CLASS-BY-CLASS RESULTS

CLASS 1

Placing	Pilot	Aircraft	Declared take-off distance (yd)	Marks (max 300)	Landing distance (yd)	Marks (max 300)	Engine starting (secs)	Marks (max 50)	Comfort and convenience (max 200)	Condition and equipment (max 300)	Baggage (max 200)	Total marks	Placing overall
1	T. C. Murray	Super Cub	75	262.5	57	271.5	12	38	136	119	96	923	3*
2	J. Severne	Linnet	215	192.5	98	251	5	45	129	164	139	920.5	4
3	B. J. Snook	Super Cub	100	250	87	256.5	15	35	135	119	96	891.5	6
4	D. M. Hartas	Jodel D.117	170	215	106	247	8	42	125	127	100	856	9
5	Miss M. McKellar	Hornet Moth	200	200	123	238.5	7	43	115	106	126	827.5	12**
6	J. O. Hodgson	Tipsy Trainer	164	218	121	239.5	5	45	96	62	60	720.5	16
7	C. Gregory	Taylorcraft	170	215	100	250	9	41	92	52	61	711	17
8	P. W. Brooks	Chipmunk	250	175	0	0	26	24	94	174	78	545	24
9	N. H. Jones	Turbulent	250	175	0	0	18	32	119	130	60	516	25
10	P. G. Masefield	Chipmunk	0	0	0	0	13	37	102	187	78	404	27

CLASS 2

1	M. D. Parry	Helio Courier	90	255	117	241.5	7	43	107	182	142.5	971	1†
2	R. A. Smith	Commanche	250	175	217	191.5	10	40	157	191	106.5	861	7
3	C. P. Francis	Jodel D.140	150	225	124	238	6	44	143	95	114	859	8
4	D. Jackson	Monarch	250	175	150	225	9	41	132	170	40	783	13
5	J. Heaton	Jackaroo	130	235	106	247	8	42	79	123	21.5	747	14
6	K. Rutter	Prospector	0	0	103	248.5	11	39	133	163	158.5	742	15
7	R. H. McIntosh	Cessna 175	0	0	127	236.5	9	41	150	197	74	698.5	18
8	P. Austin	TriPacer	150	225	0	0	8	42	137	217	48.5	669.5	19
9	N. A. L. Thorne	Auster V	175	212.5	0	0	17	33	98	160	117.5	621	20
10	P. B. Cash	Messenger	0	0	87	256.5	14	36	115	165	39.5	612	21
11	H. W. Gray	Proctor V	0	0	250	175	6	44	95	175	109.5	598.5	22
12	J. Dougherty	Meta-Sokol	250	175	0	0	9	41	135	200	16.5	567.5	23
13	J. C. C. Taylor	Proctor I	375	112.5	0	0	0	0	95	146	116.5	470	26

CLASS 3

1	T. A. Vigors	Aztec	200	200	244	178	15	35	164	287	89	953	2‡
2	M. A. Smith	Gemini	220	190	121	239.5	9	41	126	177	126	899.5	5§
3	C. M. Lambert	Aero 45	300	150	171	214.5	21	29	128	260	56	837.5	10
4	D. B. Cartlidge	Piaggio P.166	300	150	0	0	18	32	165	284	200	831	11

*John Percival Challenge Trophy and T. A. Vigors £100 award for aircraft with best take off and landing performance. †Osram Cup and Kemsley Challenge Trophy; overall winner. ‡Grosvenor Challenge Cup. §Special prize for aircraft registered before 1950. **Special prize for aircraft registered before 1950 (second place). Prizes were awarded for first four in each class.

Helicopters of the World

A "Flight" Review of Current and Projected Types

GREAT BRITAIN

Westland Aircraft Ltd

Yeovil, Somerset

This leading British helicopter manufacturing concern now incorporates Saunders-Roe Ltd, the Helicopter Division of Bristol Aircraft Ltd, and Fairey Aviation Ltd.

Wessex 1 As at present in production the Wessex is an anti-submarine helicopter for the Royal Navy; but a civil version is in prospect. Essentially the Wessex is an anglicized development of the piston-engined Sikorsky S-58. Powered with a Napier Gazelle, it has the distinction of having been the first large turbine-powered helicopter to be placed in full production.

Light-alloy monocoque construction is used throughout with the exception of the welded steel-tubular portion in the region of the main gearbox and rotorhead pylon. The rotor blades are of light-alloy; the leading edge is an extrusion, bonded to light-alloy "pockets" which make the blade into an aerofoil section. All blades are interchangeable and can be folded. Fully duplicated servos control the main rotor movement.

Fully integrated autostabilization equipment of limited authority reduces pilot fatigue and permits holding attitude, heading and height. Additional devices are used to increase the efficiency of the naval operation. These systems may be used at all speeds down to the hover.

The Napier Gazelle (1,200 s.h.p. continuous) is mounted in the nose, inclined at an angle to minimize the length of the shaft drive and to effect space saving.

The anti-submarine Wessex can make simultaneous search and strike sorties while retaining the facility for rapid conversion to other duties. Provision is made for an advanced Asdic installation and for a variety of strike weapons. Arrangements are made for slinging an external load of 4,000lb, for winching 600lb, and the structure is stressed to accept loads imposed by mine-sweeping gear. As a civil transport the Wessex could accommodate twelve passengers with light hand luggage. Large windows would be provided.

● Rotor diam, 56ft; overall length, 65ft 9in; basic weight, 7,600lb; gross weight, 12,600lb; max speed, 132 m.p.h. (gross weight); economic cruising speed, 115 m.p.h.; vertical rate of climb at s.l., 600ft/min; hovering ceiling (free air) 1hr power, 5,000ft.

Wessex 2 Now in the project stage, the Mk 2 Wessex will be powered with two de Havilland Gnome H.1200 shaft turbines. It is being considered by the RAF and the Royal Navy, and has obvious attractions in the civil transport role. The rotor system of the Wessex 1 would be used, but the Mk 2 aircraft would have ample power for single-engined operation and, as an additional safeguard for over-water routes, improved ditching characteristics. The increased power would not be used for normal level flight—there would be a transmission limitation of 1,500 s.h.p.; but the reserve would maintain performance under tropical conditions or at altitude, and the engines would normally be running in a light-load condition, with consequent gain in overhaul life. Cabin size would be increased, undercarriage track widened, and various additional equipment installed. Various layouts are in prospect, for twelve, fourteen or fifteen passenger seats.

Whirlwind (Leonides) Powered with the Alvis Leonides Major piston engine (750 h.p. max.) the Whirlwind continues to be offered for civil and military applications. Aircraft of this type (Mk 8) have been supplied to the RAF for service with the Queen's Flight. A current operational version is the Mk 7, developed specifically for anti-submarine duties.

The Whirlwind is offered for the following duties: passenger transport carrying eight passengers to civil seating standards, or ten to military standards and two crew; winch rescue with an hydraulically powered hoist, lifting two people; anti-submarine operations, carrying either submarine search equipment or a strike weapon; ambulance work, carrying six stretchers and a medical attendant; freight duties with a 2,000lb lift on an external sling; towing ships or ground equipment; water landings with flotation gear; and spraying duties for insecticide and pest control.

● Rotor diam, 53ft; fuselage length, 42ft; equipped weight, 5,375lb; normal gross weight, 7,800lb; max cruising speed, 99 m.p.h.

Whirlwind (Gnome) Whirlwinds of the RAF are to be re-engined with the de Havilland Gnome and new (Mk 10) Whirlwinds will be built from the outset with this powerplant. Considerations which led to the installation are that the low weight gives a saving of about 675lb over the piston engine; payloads are much higher; or addi-

Left, Westland Wessex 1. Below, Wessex 2. Heading, l. to r. Westminster, Wessex, Gnome-Whirlwind, Leonides Major Whirlwind, Widgeon, Wasp, Skeeter

Westland Whirlwind (Leonides Major)

Westland Whirlwind (Gnome)

HELICOPTERS OF THE WORLD . . .

tional fuel can be carried for long-range missions. Alternatively, for the same payload, the performance of the aircraft is improved. Lower blade loadings make handling easier and higher maximum forward speeds are possible before blade-stall is encountered. Also possible are higher vertical rates of climb, and performance is enhanced both at high ambient temperatures at sea level and at altitude. For use in tropical conditions engine cooling is not so critical as with the earlier piston units, and the transmission system is simplified because the free turbine does not require a clutch.

● Equipped weight, 4,761lb; gross weight, 8,000lb; hovering ceiling without ground effect, 7,500ft; max permissible speed (theoretical), 126 m.p.h.

Widgeon Powered with an Alvis Leonides 521/2, the Widgeon continues to be offered for public transport with pilot, four passengers and luggage; pilot training with side-by-side seating and full dual control; ambulance work, carrying two stretchers internally and medical attendant; search and rescue, using detachable hydraulically operated winch capable of lifting two people simultaneously; freight transport, with jettisonable sling for external loads of 1,000lb; spraying and dusting for pest control and crop culture; anti-submarine detection, using detachable pack unit containing sonar gear; police and coastguard patrol, using loud-hailer unit; and waterborne operations, using floats.

● Rotor diam, 49ft; fuselage length, 41ft; empty weight, 4,322lb; gross weight, 5,900lb; economic cruising speed, 80 m.p.h.; hovering ceiling with 10ft wheel clearance in ground effect, 6,170ft; range at economic cruising speed with standard tanks, 260 n.m.

Westminster Two prototypes of the Westminster are now flying with a view to proving the characteristics of machines of this type in the heavy-duty role. Both are powered with two Napier Eland gas turbines, driving a five-blade rotor. The design provides for the carriage of loads externally, although it is possible to dispose internally as well where shape and size permits. Investigations have shown, however, that for crane duties and for many transportation duties over distances up to 100 n.m. freight and equipment are best carried externally.

Of the military applications the makers state:—

"With a disposable load of some 14,000lb the Westminster meets the requirements for a large military transport helicopter able to carry heavy field equipment, atomic and nuclear weapons and troops over stages of 150 n.m. or more. Provision exists for the attachment of lightweight panels to enclose sections of the open framework fuselage where this is desirable for certain roles such as troop carrying. Operating at an all-up weight of 36,000lb and with sufficient fuel for 30min hovering, the Westminster will lift a load of 12,700lb. Over short stages of 100 n.m., say, from beach-heads or off-shore bases to assault or supply areas, a payload of some 11,200lb can be transported flying on two engines at a modest cruising speed of 80kt. This range could, however, be increased by some 30 per cent if flying were restricted to one engine only. With sections of the fuselage enclosed it is possible to transport 51 fully equipped troops within the fuselage."

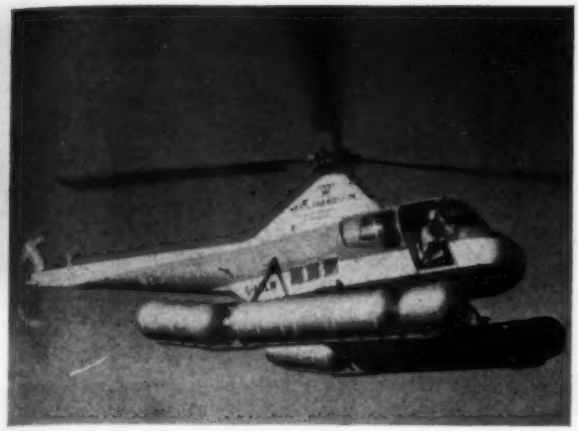
In addition to trooping, the Westminster could operate in the weapon-supply role, for the transport and recovery of vehicles, and as a mobile-unit transporter. In the latter connection units such as living huts, emergency hospital wards, fitted kitchens, vehicle servicing units, decontamination centres and operations control centres could easily be slung beneath the aircraft.

● Rotor diam, 72ft; overall length, 89ft 3in; basic weight, 21,600lb; normal gross weight, 36,000lb; cruising speed, 115 m.p.h.; max range, 180 n.m.; vertical rate of climb (two engines at 86 m.p.h.), 1,900ft/min.

Rotodyne Powered, in its present form, with Napier Elands, the Rotodyne will, in its enlarged production version, be engined with Rolls-Royce Tynes. It has the capabilities both of a helicopter and a fixed-wing aircraft and main features of both, namely, a rotor and a fixed wing with tractor propellers. The rotor is of the torqueless type, being driven by pressure jets at the tips of the blades. This eliminates mechanical transmission and the need for an anti-torque tail rotor. Directional control is achieved by differential propeller pitch at low speeds, and by air rudders at high speeds. To overcome aerodynamic limits-

Below, Westland (Fairey) Rotodyne

Right, the two Westland Westminster prototypes (one transporting a bridge)



Above, Westland Widgeon with skid-type flotation gear undercarriage

Westland (Bristol) Belvedere carrying Bloodhound missile

tions of conventional rotors at high speeds the rotor is partially unloaded and set to turn in autorotation, the remainder of the lift being provided by the fixed wing. Forward propulsive thrust is then provided through conventional propellers.

As a passenger transport the Rotodyne will be available in "passenger only," "freight only," "passenger and freight," "car ferry" and "flying crane" versions. A typical layout will have 57 seats (five abreast) at 34in pitch. If all toilet facilities are removed and the seat pitch reduced by 2in then 75 seats can be made available for very short range work.

There has been much conjecture concerning the noise level of the Rotodyne in the city-centre transport role. Numerous types of silencer have been investigated and the makers reported late last year:—

"The . . . noise level of 101db at 200ft has been achieved, and it can be confidently expected that further development work will reduce the noise level still further on the production aircraft. 101db compares very favourably with the general level of noise experienced in London; for example, the general level on an Underground station platform is about 65db, but the approach of a train raises the level to 103db. The noise level in a cafeteria is about 75db and in Piccadilly Circus 98db is not unusual. The Rotodyne will make an unusual noise, but it will not be exceptionally loud or unpleasant and it is likely that the public will get used to it and gradually accept it as part of the general background noise experienced in cities today. The number of people subjected to the 101db noise level will be very small indeed, because heliports are likely to be situated either at rooftop level or on some relatively open space to provide reasonable approach paths."

● Rotor diam, 104ft; fuselage length, 66ft 1in; operating weight (crew of three), 35,564lb; gross weight, 53,500lb; cruising speed (initial), not less than 200 m.p.h.; cruising speed (eventual), over 230 m.p.h.

Belvedere The Belvedere twin-engined tandem-rotor helicopter (Bristol Type 192 Series 2) is in quantity production for the RAF. It is powered with two Napier Gazelle NGa.2 free turbines (1hr rating, 1,465 s.h.p.) and the aircraft needs to employ little more than half the available power at low altitudes and temperatures. This, it is claimed, leads not only to a high degree of reliability, but it also enables performance to be maintained at high altitudes and temperatures. Comparatively little loss of performance results from a single engine-failure.

The essential characteristics are well known, but a recent development is a new tailplane, having the two vertical outboard fins fixed below, and at an anhedral angle to, the extremities. Metal rotor blades and the latest duplicated power controls are among other new developments. Gross weight is being raised from 18,000lb to 18,500lb, with a military overload case of 20,000lb (applying to both take-off and landing). Roles foreseen are military engineering, casualty evacuation, troop transport, strategic and tactical logistics, assault, paratrooping, rescue and combat. In the last-named role soldiers could be carried into action and the Belvedere could then function as an observation and reconnaissance post or as a fighting craft, armed with guns or rockets.

● Rotor diam, 48ft 11in; fuselage length, 54ft 4in; max speed, 138 m.p.h.; service ceiling, 17,300ft; hovering ceiling (without ground effect), 5,000ft.

Wasp This general-purpose helicopter was formerly known by the Saunders-Roe designation P.531. Examples have been ordered for the Royal Navy and the Army Air Corps. The production version is powered by a Blackburn Nimbus free turbine. There are two single seats at the front and a bench seat for three at the rear; the bench can be folded back to leave a clear space for freight or stretchers. A normal fitment is a skid landing gear, incorporating ground handling wheels, but conventional wheel gear or flotation bags are offered as alternatives. As a weapon carrier the Wasp lifts a significant load in the form of guns, rockets or wire-guided missiles. Naval stores such as mines or torpedoes may be carried beneath the fuselage. Having regard to the Wasp's intended applications particular attention has been paid to ease of maintenance under field conditions. All controls and radio, for example, are easily accessible through inspection doors, and access to instruments and certain parts of the radio is facilitated by a hinged nose section. The engine platform is sufficiently wide to provide standing room for servicing the engine and the rotor head.

● Rotor diam, 32ft 3in; length (main blades folded), 30ft 4in; weight empty (including oil), 2,836lb; gross weight, 5,000lb; cruising speed, 115 m.p.h.; max range (normal tanks), 250 n.m.

Skeeter Numerous marks of this light helicopter have been supplied for military and civil use. The Mk 12 is standardized by Britain's Army Air Corps and is powered with a 250 h.p. D.H. Gipsy Major engine, installed (as in all Skeeters) athwartships, the drive for the main rotor being taken from the end of the crankshaft on the starboard side. Provision is made for two stretchers mounted externally on the sides of the cabin.

● Rotor diam, 32ft; length (blades folded), 28ft 5in; weight empty, 1,656lb; gross weight, 2,200lb; max cruising speed, 92 m.p.h.; max rate of climb, 1,150ft/min; hovering ceiling (free air), 2,500ft.

Left, Westland (Saunders-Roe) Wasp

Below, Westland (Saunders-Roe) Skeeter

HELICOPTERS OF THE WORLD . . .

BRAZIL

Centro Tecnico de Aeronautica

Sao Jose dos Campos, Sao Paulo

Beija-Flor This two-seat helicopter (Humming Bird) was designed and built to the initial design of Professor Heinrich Focke. A forward-located Continental E225 engine drives main and tail rotors through a centrifugal clutch and a David Brown lorry worm and wheel. The makers state: "For economic reasons the material used in the construction of the helicopter is almost entirely of national origin, and due to the relatively undeveloped state of the aircraft and accessory industry in Brazil this has unavoidably led to an excessive weight. This situation will, however, be improved with subsequent prototypes now being planned. The first flights have concentrated on a preliminary assessment of control and stability and have been remarkably free of prototype 'snags'."

● Rotor diam, 29ft 6in; overall length, 27ft 8in; gross weight, 2,090lb; max speed, 93 m.p.h.; economical cruising speed, 81 m.p.h.; max rate of climb, 1,220ft/min; hovering ceiling (free air), 4,600ft; range, 169 miles.

CANADA

Avian Industries Ltd

Georgetown, Ontario

Model 2/180 Although the first prototype has been destroyed in an accident (stated in no way to reflect deficiencies in the design), work is now going ahead on a second Model 2/180. The aircraft is intended to be flown by relatively inexperienced fixe*-wing pilots. A tandem two-seater, it is based on a steel keel and rotor pylon form.ng the entire primary structure and supporting seats, controls, undercarriage and a rear-mounted Lycoming 180 h.p. flat-four engine. The three spring-steel undercarriage legs are each held to the keel by a single bolt. Propulsion in autorotative flight at cruising speeds of 150 m.p.h. is by a ducted fan propeller at the tail, with a small aerodynamic rudder mounted in the ring. Additional kinetic energy required for vertical take-off and landing to and from 200ft is provided by cold tip-jets supplied from a compressed-air container continuously charged by an engine-driven pump. The three-bladed rotor is controlled by aerodynamic tabs at the trailing-edge near the tip. Power-off approaches without tip thrust can be made at 20-25 m.p.h. with touchdown at 15 m.p.h.

● Rotor diam, 26ft; overall length, 14ft 7in; weight empty, 1,000lb; gross weight, 1,600lb; max cruising speed, 150 m.p.h.; max rate of climb, 1,500ft/min; normal range, 450 miles.

CZECHOSLOVAKIA

Omnipol Ltd

Washingtonova 11, Prague III

HC-2 Heli-Baby The first examples of this tiny two-seater have been flying with the 83 h.p. Praga DH flat-four engine but production models may have an engine of 105 h.p. The data at the end of this paragraph relate to the 83 h.p. version.

The makers claim particularly low operating costs, sturdy construction and sensitive and responsive control, and these characteristics are considered to render the aircraft suitable for training as well as for a wide range of utility applications. The standard undercarriage consists of main- and nosewheels and the engine is mounted behind the cabin, with its crankshaft inclined to the vertical. A metal monocoque boom carries the tail-rotor transmission, tail rotor, trimming surface and tail bumper. In one hour the Heli-Baby can carry a pilot and 220lb of payload over 62 miles, using only 4.85 gal of fuel.

● Rotor diam, 28ft 11in; length, 34ft 5in; empty weight, 840lb; gross weight, 1,280lb; hovering ceiling, with ground effect, 3,600ft; rate of climb, 710ft/min; max speed, 78 m.p.h.; cruising speed, 62 m.p.h.; range, 93 miles.

FRANCE

Helicop-Air

8 Rue Bellini, Paris 16e

Girhel This "combination" aircraft is powered in the first instance by a Continental 90 h.p. engine, but a more powerful unit will be fitted in a version intended for the French Air Force. The first example should fly at about this time. A low-set wing has end-plates and ailerons and carries the mainwheels of the nosewheel undercarriage. An autogyro rotor provides for low-speed flight and is speeded-up for take-off by a drive from the engine. It is claimed that a fixed-wing pilot can fly this aircraft without conversion.

● Rotor diam, 32ft 9½in; fuselage length, 20ft; weight empty, 840lb; gross weight, 1,380lb; max speed, 103 m.p.h. (Figures apply to 90 h.p. Continental engine.)

Sud Aviation

37 Bd de Montmorency, Paris 16e

Djinn Powered with a Turboméca Palouste 4 turbine air-generator, the two-seat Djinn continues in quantity production for the French Army and for foreign customers. The air-generator supplies compressed air for blade-tip ejection and, due to the high inertia of the rotor, it is claimed that the Djinn is "the most lenient of helicopters where flying faults are concerned." To this reason is attributed its success as a trainer. It is a short range aircraft, easily maintained and transported. Optional equipment includes a cargo sling, two stretchers (external), and spray equipment consisting of two spray booms with 54 nozzles fed by two 26 US gal tanks pressurized by air from the Palouste.

● Rotor diam, 36ft; fuselage length, 17ft 5in; gross weight, 1,676lb; cruising speed, 62 m.p.h.; max range, 110 miles; hovering ceiling in ground effect, 3,000ft; service ceiling, 10,000ft.

Alouette II A five-seater, the Alouette has mechanical transmission from its Turboméca Artouste 2 turbine of 400 h.p. A notable feature introduced on this aircraft is the automatic engine r.p.m. governing system designed to simplify piloting. Of this feature the makers state: "Relieved of the need to keep permanent watch on his instrument panel for the purpose of pitch and throttle co-ordination, the pilot can concentrate entirely on the assigned mission (surveillance or observation, for instance)." An exceptional centre of gravity range is claimed, all loading configurations being possible without ballasting. The Alouette has already been operated in every role suited to an aircraft of its class, including anti-submarine operations. Carrying two torpedoes, and based on the fantail of a destroyer, it is claimed to double the efficiency of the vessel by delivering the weapons close to

Beija-Flor

Avian Model 2/180

HC-2 Heli-Baby

Helicop-Air Girhel

Sud Frelon (SE.3200)

Sud Alouette II

Sud Djinn

Sud Alouette III

HELICOPTERS OF THE WORLD . . .

a submarine which has been spotted by the ship's radar.

● Rotor diam, 33ft 6in; fuselage length, 31ft 10in; gross weight, 3,300lb; cruising speed, 106 m.p.h.; hovering ceiling (free air), 6,500ft; range, 290 n.m.

Alouette III This new helicopter is a direct derivative of the Alouette II and benefits from the large-scale production and operation of that type. It differs from the earlier machine in having a slightly reinforced transmission system and in being powered with an Artouste 3B, a development of the Artouste 2, with more reserve power. Equipment and general layout are improved and the whole airframe has been cleaned up; particularly noticeable is the semi-monocoque tail boom. Two baggage holds are provided in the centre portion, on either side of the welded structure and enclosed by fairings. The cabin seats three at the front and there is a four-place folding seat at the rear. Two stretchers can be accommodated athwartships in the rear cabin. There are four doors.

● Rotor diam, 36ft 1in; overall length (blades folded), 33ft 1in; weight empty, 2,300lb; normal gross weight, 4,190lb; max gross weight, 4,630lb; cruising speed, 111 m.p.h.; hovering ceiling (free air), 13,100ft; range, 300 n.m.

Frelon (SE.3200) This large three-engined helicopter, capable of carrying 24 fully equipped troops, is powered, in prototype form, with Turboméca Turmo 3Bs (750-800 h.p.), but production machines will have Turmo 3Cs of 1,000-1,100 h.p. each. Equipment includes dual flying controls and navigation installations, full night-flying equipment, and provision for an autopilot. Great ease of loading is claimed, there being a 23ft-long free loading area, numerous large side doors, and a swinging tail section. In the casualty evacuation role 15 stretcher patients and two attendants can be carried over 220 n.m., and as an air/sea rescue craft the Frelon could retrieve 10 shipwrecked persons at 160 n.m. from its base. With sonar gear the aircraft could stand a 3hr watch, and 3,000lb of anti-submarine weapons can be carried for 200 n.m.

● Rotor diam, 49ft 2in; overall length (blades folded), 48ft 10in; weight empty, 9,920lb; normal gross weight, 16,530lb; overload gross weight, 17,640lb; max ferrying range, 700 n.m.

GERMANY

Bölkow-Entwicklungen KG

Ottobrunn Bei München

Bö 102 Heli-Trainer Of this unique development the makers report: "With the aid of the Heli-Trainer it is possible to give helicopter students a sound, practical and academical training in the basic elements of helicopter flying at the lowest possible cost, and without any risk of accidents. Experienced rotor-blade specialists have developed the Heli-Trainer, which, following extensive trials, is now in use in training establishments for helicopter pilots. The main part of the system is a single-seat, single-rotor helicopter, which can both turn and change its altitude when mounted on a tripod. When mounted on a float all manoeuvres of a helicopter in flight can be practised. Elastic buffers prevent any damage even in cases of mishandling of the controls. On the water an inflatable stabilization ring limits tilt around the lateral and longitudinal axes. Due to the special design of the Heli-Trainer it is possible for the first time to practise the basic manoeuvres and reactions of a helicopter in flight, either in separate or linked phases without any risk. The instructor, from his seat next to the cabin, can give instructions and make any necessary corrections."

Carl F. W. Borgward G.m.b.H.

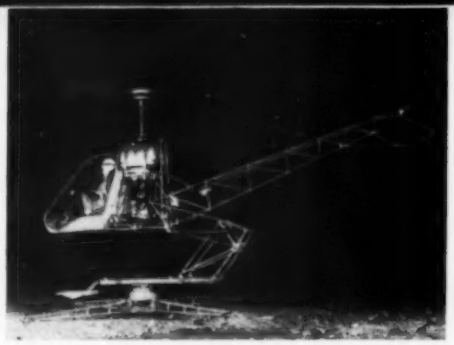
Bremen

Kolibri I As will be seen overleaf this helicopter—the first of domestic design to have been flown in Germany since the war—is at present flying in semi-skeletal form, but a faired-in version is in

HELICOPTERS OF THE WORLD . . .

prospect. The Kolibri has a steel-tube airframe, housing a three-seat cabin forward and powerplant amidships, with metal skin. The tail boom is fabric-covered. Power for the three-bladed main rotor and twin tail rotors is provided by a Lycoming VO-435-A engine, giving 260 h.p., driving the main rotor through a two-stage 10:1 reduction. The conical housing for the main vertical shaft also forms the transmission oil tank and further drives are taken for the tail rotors, engine-cooling fan and a series of oil pumps for lubrication and hydraulic power. Engine oil is used in the hydraulic system.

● Rotor diam, 30ft 10in; fuselage length, 27ft 3in; gross weight, 2,645lb; cruising speed, 87 m.p.h.; absolute ceiling, 14,760ft.



Bölkow Bö 102

Borgward Kolibri I

ITALY

Costruzioni Aeronautiche Giovanni Agusta

Cascina Costa, Gallarate

Bell 47 Series Agusta are constructing under licence helicopters of the Bell 47G and J series. These are essentially the same as the American machines, but one notable development is a version of the 47J seating pilot and four passengers (the latter on a single bench seat). In addition, the following types, partly or wholly of indigenous design, are being developed.

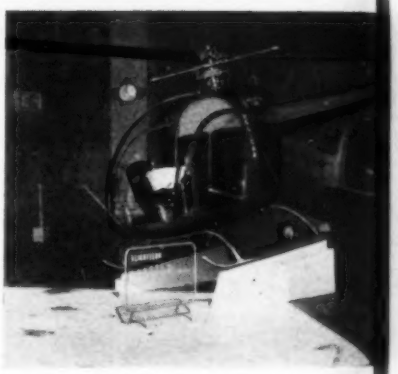
Agusta AZ-101G

AZ-101G A prototype of this 30-passenger helicopter has been ordered by the Italian Air Force. This will be powered by three de Havilland Gnomes, rated at 1,050 h.p. for take-off. The main and tail rotors are four-bladed and the undercarriage is four-wheeled, the rear wheels being provided with brakes and the front wheels with shimmy dampers. There is a rear loading ramp which may be kept open in flight to permit the dropping of parachutists. Several versions, including one for anti-submarine operations, are in prospect.

● Rotor diam, 64ft; fuselage length, 54ft 1in; empty weight, 12,566lb; gross weight, 24,030 lb; max speed at max cont. power, 143 m.p.h.; cruising speed for max range, 125 m.p.h.; rate of climb (max cont. power), 1,280ft/min; hovering ceiling in ground effect, 9,840ft.

Model 102 Powered with a Pratt & Whitney R-1340 piston engine of 600 h.p., the Model 102 will carry up to nine passengers plus 250lb of baggage or equipment (up to a range of 62 miles). For ranges up to 220 miles it will carry seven passengers plus 260lb. The rotor system is of the classic Bell type and the aircraft is of uncommonly clean design.

● Rotor diam, 47ft 7in; fuselage length, 41ft 9in; gross weight, 6,280lb; cruising speed for best range, 100 m.p.h.; hovering ceiling (free air), 6,050ft.



Agusta Model A104 Helicar

A104 Helicar Of this new helicopter the makers state: "In order to complete the series of helicopters built at its plant the company has decided to start manufacturing a low-priced helicopter having reduced dimensions and requiring low maintenance. This helicopter is the Model A104. It is derived from the Agusta Model A103. The A104 may be supplied either as a single-place or two-place. It is powered by an engine rated at 140 h.p., which permits it to obtain outstanding performance, thus allowing accomplishment of a large variety of operations, even at high altitudes." (The engine is an

Fiat Model 7002

Agusta Model 102

NHI Kolibrie

SM-1

Agusta M.V.120—a new unit in the Agusta series.)

● Empty weight, 838lb; gross weight 1,411lb; cruising speed, 84 m.p.h.; rate of climb at s.l., 787ft/min; hovering ceiling (free air), 2,950ft; max range, 205 miles.

Societa Per Azioni Fiat

Corso Giovanni Agnelli 200, Turin

Model 7002 A photograph on page 716 shows for the first time this helicopter in the open air. It shows also the unconventional layout. The two-blade main rotor is driven by cold jets, compressed air being supplied by a Fiat 4700 turbo-generator in which the turbine-driven air-compressor is operated by a hot-gas generator, or primary engine, that embodies almost completely the components of the Fiat 4002 turbojet. Although, in the absence of torque reaction, it would have been possible to abolish the tail rotor, it was in fact decided to install a small ducted rotor, mechanically driven by the main rotor, for directional control. This ensures maximum manoeuvrability at low forward speeds and in autorotation.

The fuselage is made up of light-alloy sheets and embodies very large transparent panels. A typical layout will provide for one pilot and six passengers.

● Rotor diam., 39ft 4in; fuselage length, 20ft; empty weight, 1,320lb; gross weight, 3,085lb; cruising speed, 84 m.p.h.; service ceiling, 11,150ft.

Aer Lualdi & C. S.p.A.

95 Via Panama, Rome

L.59 A development of the L.55, this four-seat helicopter, powered with a 180 h.p. Lycoming O-360, has a Hiller-type two-blade main rotor. The doors are of car type and there is provision for two stretchers.

● Rotor diam., 34ft 9in; fuselage length, 29ft 9in; empty weight 1,475lb; gross weight, 2,555lb; cruising speed, 86 m.p.h.; hovering ceiling (free air), 5,575ft.

NETHERLANDS

Nederlandse Helicopter Industrie N.V.

Veerdam 44, Papendrecht

NHI H-3 Kolibrie The first ramjet helicopter to be operated commercially, the little Kolibrie has rotor-tip units which, in terms of the makers' claim, "considerably simplify its construction, permitting a selling price of less than half the price of similar helicopters of conservative construction." The makers further state: "Also the cost of maintenance is comparatively low, while maintenance is very simple. Engine changes, when necessary, require no more than ten minutes. Unfortunately ramjet engines have the disadvantage of a high fuel consumption (low cost kerosine) at subsonic speeds and for the Kolibrie the consumption averages 460 litres per hour, rendering the aircraft unsuitable for operations of long duration. Maximum flight time using all lifting capacity for carrying fuel does not exceed one hour. This makes the Kolibrie only useful for short missions, such as agricultural spraying and helicopter pilot training. Especially when employed in crop-spraying work with the generally low annual numbers of flying hours, the low purchase cost of the Kolibrie is a very advantageous factor, besides the very high safety and reliability, which are of great importance in this kind of work." The TJ5-A ramjets have an output of 60 h.p. each. Two seats are normally installed.

● Rotor diam., 32ft 7in; fuselage length, 13ft 10in; empty weight, 664lb; gross weight, 1,540lb; cruising speed for max range, 56 m.p.h.; hovering ceiling (free air), 490ft; vertical rate of climb, 130ft/min.

POLAND

Motoimport

Przemyslowa 26, Warsaw

SM-1 This Polish-built version of the Russian Mil Mi-1 continues to be offered in agricultural, ambulance and executive versions. The engine is a Russian 575 h.p. AI-26W radial and typical accommodation is for pilot and three passengers. A fluid de-icing system is provided for the rotors and the windscreen can also be de-iced by fluid spread over the glass by the wiper. Engine oil may be diluted to facilitate starting in extreme cold. The inside of the windscreen can also be heated by hot air. De-icing fluid is contained in a 6 Imp gal tank with a secondary supply in a tank holding 0.6 Imp gal.

● Rotor diam, 47ft; length, 40ft 9in; empty weight, 3,925lb; gross weight, 4,960lb; max speed at s.l., 124 m.p.h.; max vertical rate of climb, 1,280ft/min; hovering ceiling, 9,840ft; max range at 87 m.p.h., 240 miles.

S-2 A reported five-seater development of the SM-1, with enlarged forward fuselage but having the same rotor.

SPAIN

Aerotecnica S.A.

Velazquez 38, Madrid

AC-12 This helicopter is of unusual layout, points of particular interest being the high concentration of mass achieved by mounting the Lycoming O-320 168 h.p. engine above the cabin, close to the rotor head. Two fans draw cooling air down through oil coolers past the two pairs of cylinders. The rotor-head controls are of ingenious layout and are claimed to provide balanced, light forces without any form of power assistance.

● Rotor diam, 27ft 10in; length, 22ft 8in; empty weight, 1,280lb; gross weight, 1,800lb; max speed, 87 m.p.h.; cruising speed, 71 m.p.h.; hovering ceiling in ground effect, 7,870ft; range, 214 miles.

AC-14 Powered by a Turboméca Artouste 2 of 400 h.p., this helicopter is a five-seater. The engine is mounted, like that of the AC-12, above the cabin, and the high-inertia rotor runs at constant speed. Construction of the four main-rotor blades is similar to that used in the AC-12, but the complication and relative unreliability of a tail rotor has, according to the designer, been avoided by using the residual thrust of the engine for anti-torque power. This air is led to the tail and vented into a bifurcated nozzle. The end of the tail-pipe can be swivelled from the rudder pedals to alter the proportion of air deflected in each direction and achieve directional control. At the same time the rudder linkage moves twin fins, which assist in providing directional control after engine failure. In order to increase the cruising speed the bifurcated nozzle can be opened to vent the engine air straight backwards and provide forward thrust. In this condition the aerodynamic rudders alone ensure directional control.

● Rotor diam, 31ft 6in; length, 26ft 6in; empty weight, 1,378lb; gross weight, 2,646lb; max speed, 118 m.p.h.; cruising speed, 103 m.p.h.; hovering ceiling in ground effect, 16,075ft; range, 280 miles.

Aerotecnica AC-12

Aerotecnica AC-14

HELICOPTERS OF THE WORLD . . .

U.S.S.R.

Kamov

Ka-15 Two-seat helicopters of this type are thought to be extensively used by State collective farms and others are believed to have been provided for the use of fishing vessels. There are two contra-rotating, co-axial three-blade rotors, driven by a 255 h.p. AI-14V radial. Most of the structure is metal, with metal and plywood covering.

● Rotor diam, 32ft 8in; cruising speed, 75 m.p.h.; hovering ceiling, 2,200ft; service ceiling, 9,800ft.

Ka-18 Figures reported for the latest model of this helicopter are quoted at the end of this paragraph. The Ka-18 is a development of the Ka-15, having a lengthened and redesigned forward fuselage with a cabin accommodating four persons instead of two. It is used for mail and freight carrying and geographic survey, as well as for communications and ambulance work. Each of the co-axial rotor blades can be detached by two people in five minutes. The structure is a welded steel-tube truss with a monocoque tail boom; the fuselage is dural-skinned; the engine is an AI-14VF of about 270 h.p.

● Rotor diam, 32ft 8in; length, 23ft; empty weight, 2,270lb; gross weight, 3,307lb; max cruising speed, 80 m.p.h.; max range, 280 miles.

Mikhail Mil

Mi-1 Quantity production of this very widely used helicopter appears to be continuing. There are numerous versions for numerous duties, both military and civil. The passenger version has 3-4 seats and the agricultural version carries about 880lb of chemicals in tanks one on each side of the fuselage. For ambulance duties panniers for stretcher cases can be similarly disposed. In the mail-carrying role also auxiliary panniers are used. The engine is an AI-26V giving 575 h.p. for take-off. Data are essentially those already quoted for the Polish SM-1.

Ka-18

Mi-1

Mi-3 The principal difference between this type and the Mi-1 is the more efficient four-blade (instead of three-blade) rotor. There are also fuselage modifications, and the gross weight and disposable load are rather higher.

Mi-4 Admitted by American experts to be a helicopter of very high quality indeed, although by no means of recent design, the Mi-4 continues in production for civil and military duties. The normal military model can accommodate the Soviet equivalent of the jeep, a small car, a 75mm anti-tank gun, or two motor-cycle sidecar combinations. Fourteen armed soldiers are another possible load and a passenger version supplied to Austria can seat up to sixteen.

The variant used by Aeroflot is known as the Mi-4P and seats ten passengers while providing ample space for luggage. This version is characterized by square—instead of round—windows, and there is no underslung gondola for the navigator, as on the military machine. In one agricultural version the gondola is used as a distributing point for chemicals.

The standard powerplant of the Mi-4 series is the ASh-82V developing 1,700 h.p. Provision is made for blind- and night-flying, and there is an anti-icing system, as on the smaller Mi types. The four-bladed main rotor has hydraulic servo control. A notable feature of the metal fuselage, especially from the military aspect, is the clamshell doors at the rear.

● Rotor diam, 68ft 11in; gross weight, 15,873lb; disposable load, 2,645-3,527lb; max speed, 116 m.p.h.; ceiling, 19,750ft.

Mi-6 This is the mammoth among the world's helicopters, being much larger in size and having much greater capacity than any rival. It has, moreover, a high speed and has established numerous world records, including an average of 167.2 m.p.h. over a 62-mile course, and a load-lift of no less than 26,465lb to a height of 4,400ft. The engines are two Soloviev TB-2BM free turbines of 4,635 s.h.p. each. These units were specially designed for the Mi-6 and are mounted atop the forward fuselage, as seen in the accompanying photograph. It will also be noted that the Mi-6 has wings, to unload the five-blade rotor. This rotor measures well over 100ft in diameter and works in

(Continued on page 725, after feature article on helicopter commercial operations)

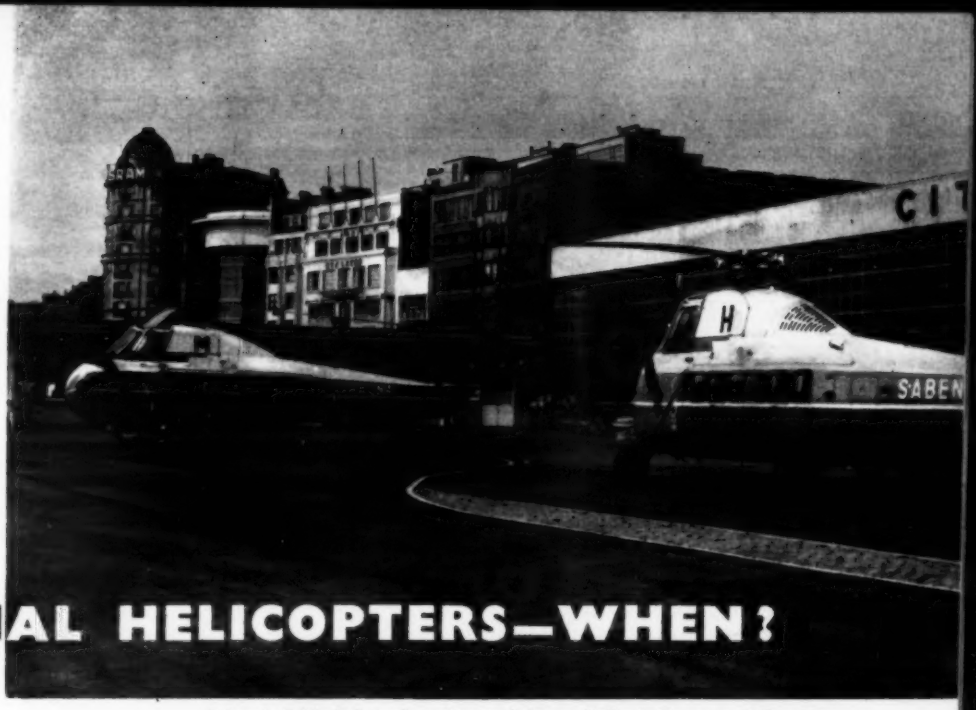
Mi-4P

Yak-24K

Mi-6

Dreams and Reality: An Assessment of Progress in Passenger and Freight Helicopter Operations

By JOHN W. R. TAYLOR



COMMERCIAL HELICOPTERS—WHEN?

Sabena's S-58s link twelve cities in Belgium, Holland, France and Germany

BY the end of 1960 Aeroflot plans to operate 216 helicopter lines in the Soviet Union, of a total route-length of 6,200 miles. Services are already in operation at Yalta, Simferopol, Sochi and neighbouring points, and it is intended to extend the network to cover the Far East, Eastern Siberia, Central Asia, the Caucasus, Syktyvkar and Baku, using Mi-4s throughout.

All the Moscow airports are to have feeder services running from a site in the city, probably near the Leningradskoye Shosse in the north. It also seems likely that Aeroflot will run a Moscow - Leningrad helicopter service, to avoid the present time-wasting 45-minute journey from the city centre to Sheremetivo—the point of departure for Leningrad—which nearly doubles the overall time taken to reach that city by air. These facts were given to *Flight* by Aeroflot, no doubt with considerable pride, via A. W. Collard, commercial assistant to BEA's manager in Russia.

The city traffic problem mentioned above is not, of course, peculiar to Moscow. In fact, we could substitute "London Airport" for "Sheremetivo" and "Paris" for "Leningrad" to spotlight our own comparable air traveller's deterrent. The difference is that *we* are doing very little about it. The fault does not lie with BEA, which is in business primarily to carry people in fixed-wing airliners and try to make money by doing so. The national Press would delight in publicizing the heavy losses that would result from operating a shuttle service between London and its airport with the helicopters at present available; and there is no indication that the Government would be prepared to underwrite such losses by heavy subsidies. To this extent it is right that BEA should wait until more economical equipment is available; but from the helicopter manufacturers' viewpoint this might be too late.

Eventually a decision will have to be taken on the ultimate form of city-to-airport transportation for London, and the much-advocated monorail has such enormous advantages over the helicopter in terms of all-weather capabilities, reduced noise and absence of air traffic control problems that it must offer the greater attraction. It would be costly to install; but it is significant that the Russians are already planning to link Vnukovo Airport to the city's south-western suburbs with a nine-mile overhead railway, on which 75-passenger coaches will travel at up to 100 m.p.h.

Airport feeder services are only one of many applications for the transport helicopter; but it would be a mistake to underestimate their importance. As the maps on page 721 show, all three of America's helicopter airlines have based their operations on this type of work. If we study the present route-network of Chicago Helicopter Airways we find that it consists of a triangle of services from Meigs Field in the Chicago Loop to Midway and O'Hare Airports, with suburban services to Winnetka, Ill, and Gary, Ind. Last year CHA carried a world record total of 204,389 passengers on these routes, of whom *approximately 50 per cent travelled on tickets issued by other US domestic and foreign airlines.*

This interline co-operation has been a major factor in CHA's rapid growth. All major airlines can issue a through ticket to include a CHA flight, and the helicopter line can offer similar services in return. As a result, a passenger to or from Chicago has no need to buy additional tickets or follow up his luggage when changing from helicopter to fixed-wing airliner or *vice versa*. Nor are the operators' benefits one-sided. American Airlines have lost no time in advertising the fact that people living in Chicago's North Shore suburbs are now only four-and-a-half hours from San Francisco "by Helicopter and Jet Flagship."

As in Britain, the advent of high-speed jet travel has made the anachronism of slow city-to-airport road transportation even more apparent. Chicago has its traffic bottlenecks, and many a passenger carried from New York to O'Hare Field in 75 minutes has rebelled at the prospect of taking as long to go by taxi from there to downtown Chicago. CHA, with a passenger fleet of eight Sikorsky S-58s, does the trip in 11 minutes, and with 158 services a day over the network there is little waiting for the rotary-wing taxi.

Thanks to a generous government subsidy, fares are not high. On the run from O'Hare to Meigs Field the helicopter fare is $6.60 (£2 7s) compared with $7.50 (£2 13s) by taxi. From Midway the taxi is cheaper, but at the cost of a journey time of 40-70min, against 7min by helicopter. Little wonder that local residents use the services as they would a bus, a typical regular customer being the pilot of a local company's executive aircraft; by flying CHA he saves about ten hours a week in commuting time.

Here, then, is an object-lesson in how to build up a thriving operating company and give the public first-class service, even with equipment that is far from ideal for the job it has to do. The whole business is made possible by the subsidies, and CHA's 11th annual report reveals that "revenues received for carrying the mail (over 39 million letters), together with governmental payments for CHA's role in developing scheduled mail and passenger service by helicopter, totalled $1,786,726." This works out at around £638,000 (appreciably less than the cost of one Victor), including the mail payments, and can hardly be considered excessive.

Of course, CHA has one big advantage over other operators. Its executive vice-president, C. Wesley Moore, made this clear when he stated in an interview:—

"Some people are surprised when they come to Chicago and find that our main operation is between the airports. They seem to think we should be flying somewhere else. They fail to realize that our biggest potential is here. Midway is the aviation crossroad of the nation—the world's busiest airport, with more than 1,200 aeroplane movements a day. O'Hare is going to be the world's largest airport. Meigs Field has more activity than any other single-runway airport in the world. The passengers have to be moved from one airport to another and between the airport and downtown Chicago.

"The fixed-wing airlines are not allowed to serve Midway and O'Hare on the same flight. That not only would increase the air traffic density, but fixed-wing planes could not get in and out of the airports as fast as we do. They would still be preparing for take-off by the time we landed at the next airport. One airline captain told me the airspace here is so saturated that it would be easier for him to fly a DC-7 from Chicago to San Francisco than from Midway Airport to O'Hare Field!"

Such air-traffic density calls for precise flying on the part of the helicopter pilots, who have to remain within a half-mile of their allotted course at all times, and within a quarter of a mile in certain areas. Cruising height is restricted to 1,500ft generally

COMMERCIAL HELICOPTERS—WHEN? . . .

and 500ft in the airport control zones, to keep the helicopters under the fixed-wing umbrella. This may sound like a controller's nightmare; but CHA had flown nearly 5m miles and 8m passenger-miles by the end of 1959 with a perfect safety record.

Now the company is preparing to switch to turbine power and has ordered six 25-passenger twin-turbine Sikorsky S-61s for delivery next year. With these it expects to be carrying over a million passengers annually by 1962. What is more, it hopes to be able to dispense with government subsidies by 1965.

CHA's success story is duplicated by the other two US helicopter airlines. Los Angeles Airways' operation, for example, was initiated and has developed entirely as an airline-connecting feeder service, carrying passengers, mail and express freight between Los Angeles International Airport and 14 heliports, serving more than 20 suburban cities and communities. These (as Mr K. might care to note if he ever plans to visit America again) include Disneyland. Their total population of seven million is increasing at the rate of 1,500 people (and more than 1,000 vehicles) a day. Yet this is only part of the traffic potential, for LAA has filed an application with the CAB for authority to extend its network to 52 additional cities, so bringing almost everyone in Southern California within an hour's journey of Los Angeles International Airport.

To make this possible, LAA too has ordered a fleet of five S-61s, equipped as 28-seaters. At present it has five S-55s and two S-51s, which in 1959 hauled 4,843,118lb of mail, 2,629,576lb of air express and 43,228 passengers. Like CHA, it has joint-fare arrangements with other airlines, and the first-class joint fare from local heliports through to most eastern US destinations is only some $2 (just over 14s) more than the normal first-class fare from the International Airport. It is interesting to conjecture how many air travellers from London would take advantage of a comparable helicopter connecting flight at a cost of under 15s.

LAA's president, Clarence M. Belinn, has described the forthcoming changeover to turbine power as a "breakthrough" for helicopter operators. He claims that, added to the S-61's multi-engined, amphibious characteristics and all-weather flight capabilities, it should permit for the first time 100 per cent all-weather flying. Igor Sikorsky enlarged on this in a lecture before the Department of Aeronautics and Astronautics of the MIT, on April 14 this year, when he said:—

"Recently one of our helicopters, the S-61 (HSS-2), on a military test mission, spent over four hours in the air, 60 per cent of which time was spent in hovering and the remainder in flying at different speeds. Such capabilities, combined with the automatic pilot and radio-navigation instruments may, to my mind, result in the availability of an aircraft which will be more completely independent of bad or blind weather restrictions than any aircraft we know of.

"We can visualize such a helicopter arriving in complete darkness or fog, guided by a radio beam until it reaches a position over the spot where it is to land at an altitude of a few hundred to a couple of thousand feet. At this spot the pilot would either enter a sort of radio cone or vertical radio beam which would guide him down towards his landing, or he could transfer the piloting of the helicopter to an operator on the ground who would spot the aircraft by radar and bring it down by means of radio control. The value of such a possibility with regard to safety of operation and reliable schedules cannot be overestimated."

Indeed it cannot. What is more, the hovering and vertical-flight ability of a helicopter should make this procedure feasible in a shorter period of time than that needed to bring auto-landing of jet airliners to the everyday routine stage.

This is not the place to deal in detail with the other virtues of the turbine-powered helicopter, such as greater mechanical dependability, increased speed, ability to run on cheaper fuel, and reduced vibration and noise (it is claimed that the 850 h.p. T58 turbine has the same noise level as a 250 h.p. piston-engine). But LAA's estimate of the ton-mile and seat-mile costs of the S-61 is interesting. Taking as the basis for calculation the S-61's planned capacity of 3,120 seat-miles per hour, compared with 560 for the S-55, LAA expects to reduce direct operating costs from 20 cents per seat-mile to not more than 10 cents. Its expansion programme envisages carrying 1,000 passengers a day by 1962 and a million a year by 1970.

Main difference in the story of New York Airways is that its next-generation equipment will come from the Vertol Division of Boeing, in the shape of five to ten 25-passenger twin-turbine Vertol 107s, to replace its present five 15-seat piston-engined Vertol 44Bs. Once again the attractions are eventual all-weather capability, reduced operating costs and the ability to maintain height on one engine. This last factor means that the 107s will be able to avoid the circuitous routing pattern now mandatory for the single-engined 44Bs—which, incidentally, are being taken back by Vertol as part-payment for the new aircraft.

Looking further ahead, NYA recorded in its 1959 annual report that "the availability of the Fairey [Westland] Rotodyne—a 65-passenger direct service airliner—in 1965 should place New York Airways in an improved position to meet the growing demand for its services on an economically sound basis." However, the commitment is limited at present to a letter of intent for five Rotodynes and a "preferred production line position" for 15 more. President Robert L. Cummings has made it clear that the whole deal depends on Westland's ability to get the Rotodyne's noise level down to an acceptable figure for city-centre operations.

This problem NYA has in common with BEA, but in other respects it has immense advantages. As a start it received a Federal subsidy of $2,242,355 (£800,540) in 1959, enabling it to show a profit after carrying 124,999 passengers, 1,306,507lb of express, 751,356lb of freight and 2,209,959lb of air mail in uneconomical aircraft. Secondly, it operates in an area where the local authorities not only appreciate the value of helicopters but do all they can to encourage them.

With the co-operation of the City of New York and the FAA, the Port of New York Authority has begun construction of a second Manhattan heliport, just below the foot of Wall Street, and will have it ready for use this year. It has plans for further heliports on the east side of midtown Manhattan, in Brooklyn, on Staten Island and in Newark.

How different is BEA's position! Before it can go into the helicopter business in a big way it must convince people who have no love for helicopters that aircraft which do not yet exist will be efficient, safe and quiet enough to operate into heliports for which nobody has yet agreed a site. The whole thing is one big vicious circle, in which we shall probably throw away the leadership given by BEA's early pioneering of helicopter passenger services and the British aircraft industry's pioneering of the turbine-powered helicopter.

A major milestone was passed in 1958-59 when the Corporation's Helicopter Experimental Unit became financially self-supporting, as the result of 1,069 hours of profitable charter flying;

Helicopter-pilot's-eye view of French aviation's most successful exports: Alouette II and Caravelle at Orly Airport, both by Sud-Aviation

(Extreme left) Foretaste of the future: the Rotodyne takes off from London Airport Central

(Left) Disembarking from one of NYA's pontoon-equipped Vertol 44Bs, to be succeeded by 107s

Passengers for an Aeroflot Il-18 are brought by an Mi-4 to Adler Airport, on the Black Sea coast

but the only indication of future plans was given by Lord Douglas in the October 1959 issue of the *BEA Magazine*. He wrote:—

"BEA is studying the possibilities of several alternative small-scale scheduled helicopter services, one of which—if the difficult question of financing the operation can be resolved—we might hope to get started within the next two years, as a preliminary and 'lead-in' to later Rotodyne operations. If we undertook an 'interim' helicopter service of this kind, we should probably require a couple of 20- to 25-passenger multi-engine helicopters, in the class of the American Vertol 107 and Sikorsky S-61 or British Bristol 192C. Certainly, preliminary operations with a smaller helicopter are highly desirable, if we can afford them, before undertaking the major task of introducing into passenger service such a large and advanced aircraft as the Rotodyne."

Strangely enough, Sabena also has said little definite about its future plans. Achievements to date have been striking, because the company is still operating the world's only international helicopter passenger services, linking twelve cities in four countries with a fleet of eight Sikorsky S-58s. The 1959 total of 35,637 passengers carried was, disappointingly, lower than the figures for 1957 and 1958, which were swollen by the influx of participants and visitors to the Brussels World Fair. What makes the Sabena operation of particular interest and importance is that it is a genuine inter-city transport service as opposed to a pure feeder-line for fixed-wing airliners.

Some of Aeroflot's helicopter services also come into this category, hinting at the future potential for the helicopter as an air-bus once it becomes economical. But as yet there is no absolute proof that without subsidy the helicopter can or ever will make a profit on such services, even if the noise and traffic control problems are overcome and heliports provided. New York Airways are quoted as believing that helicopters will still be twice as expensive to operate as fixed-wing airliners in 1965; BEA believe it will be nearer three or four times. This will be quite acceptable for short "taxi" services, but will keep fares way above those of bus and rail services on longer routes.

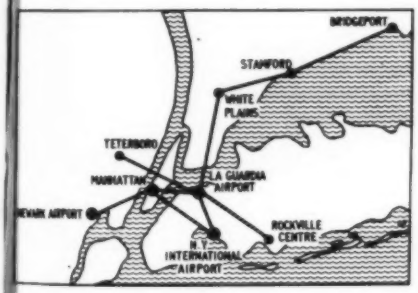
In any case, such questions will remain purely academic in Britain unless we start to provide heliports and helicopters very soon. For this reason Westland deserve great credit for building and operating London's first proper heliport. They did it before they became Britain's entire helicopter industry, so the motives were by no means selfish. The number of movements at the Battersea site must have surprised even the most optimistic enthusiast.

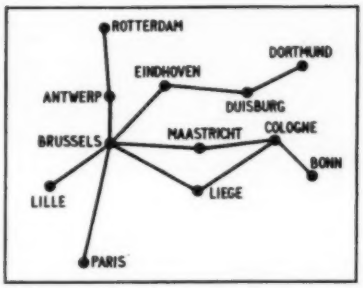
Westland themselves point out that their heliport has a life-expectancy of only five years, is too small to deal with any substantial flow of scheduled traffic, and is not near enough to the central area for the convenience of the public. Yet it handled 1,961 movements in its first year (to April 23, 1960) with a peak of 42 movements—all of them civil—on April 20.

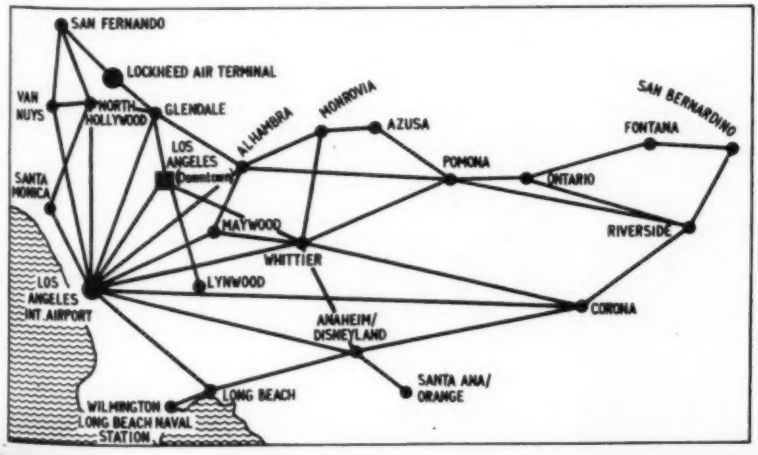
This may seem trifling compared with the operations of the US helicopter airlines, particularly as none of the flights was scheduled. But they did include the first non-stop Brussels - London city-centre helicopter flight, by the 33,000lb Westland Westminster, and it is good to know that the Minister of Aviation has been a frequent user. Since February 25 this year the heliport has held a night flying licence, and its GEC lighting system has proved highly successful. As with BEA's experimental work, all this is providing valuable experience and know-how. We can only hope that, as one cynic has commented, these developments will not be left for the Americans to commercialize and the Russians to invent.

From all that has been written here it might appear that there is no place for the small helicopter in future commercial operations; but nothing could be further from the truth. Attention has been focussed on high-frequency passenger services in major areas of population because these are the kind of prestige operations for which there is an obvious requirement and for which it should be least difficult to create public and official interest.

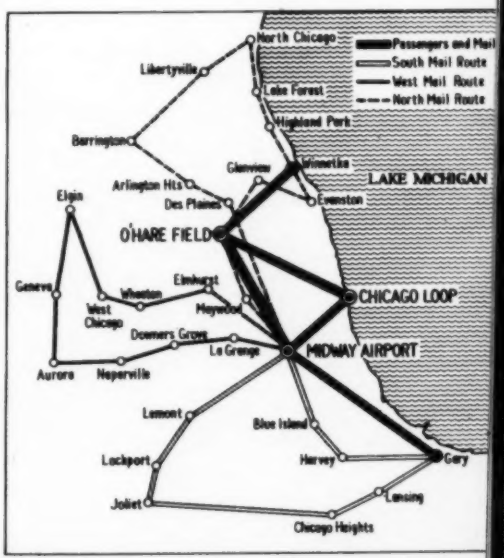
On the other hand, as is shown by the financial results of BEA's Helicopter Unit and by companies like Okanagan in Canada, the versatility of the helicopter suits it for an immense variety of non-scheduled commercial work. It is not proposed to deal with this here, as it was covered extensively by the present writer in last year's special "Helicopters of the World" number of *Flight*; but charter work will always provide much of the bread-and-butter work for helicopter operators and will involve every class of







These maps (not to scale) show four commercial helicopter networks in current operation. At extreme left are New York Airways' routes; left, Sabena's four-country network; lower left, Los Angeles Airways' system (a score more routes, over a wider radius, are planned); below, Chicago Helicopter Airways passenger and mail network, local and inter-airport



COMMERCIAL HELICOPTERS—WHEN? . . .

aircraft from the smallest two-seat agricultural sprayer to the largest flying crane.

Getting back to airline work, present indications are that 25-seaters like the S-61 will be the first helicopters to show a profit from carrying passengers on high-frequency short-range routes in and around cities in 1961-62. Economic inter-city operations over ranges of 100-200 miles will probably demand larger machines with at least 40 seats, and these should be available by 1963-65. The carriage of bulk freight, in quantities that will ensure adequate aircraft utilization, will call for the largest practicable helicopters. Nor is there any reason why the commercial helicopter should lose any of its traditional versatility as it increases in size. This is demonstrated by a delightful story.

It seems that last summer Igor Sikorsky watched patiently while the prototype S-60 Skycrane was fitted with a simple platform (see picture) and made to carry everything from oil drums to a concrete mixer and fire-fighting equipment, prior to its military evaluation. Afterwards he said: "Let's put some seats on the platform and see what it's like."

Four troop-type seats were bolted on the platform, and a telephone line was hooked up with the pilot's cabin. Seventy-year-old Mr Sikorsky donned a bone-dome, calmly strapped himself in one of the seats, and courteously motioned three of his associates to the other seats. John Vest, chief of engineering operations, Charles Echeverria, S-56 project engineer, and Roderick Smith, S-60 project engineer, followed him aboard.

The original idea was simply to hover, but this felt so good that Vest suggested they should try a trip "just once around the field." Once became twice and soon they were across the boundary and flying over the neighbouring countryside. What impressed all four passengers was the amazing lack of vibration, even during transition from vertical to horizontal flight. Several times they returned to the airfield to compare notes and talk with the pilots. As their confidence grew, the crane went higher and faster, finally reaching an altitude of 1,500ft and a forward speed of 70kt. The flight was still smooth, and a coin placed on the metal floor lay so still that its date could be read.

Igor Sikorsky did some further experimenting. He unbuckled his safety belt and walked nonchalantly around part of the platform to test the action of the flexible suspension system and the force of the wind at different positions. No one joined him in

(Left) A Sikorsky S-58 of Chicago Helicopter Airways carries its passengers swiftly over the city's traffic jams

The primary role of the commercial helicopter is to operate feeder services to airports. At right a Bell 47J connects with an American Airlines Convair

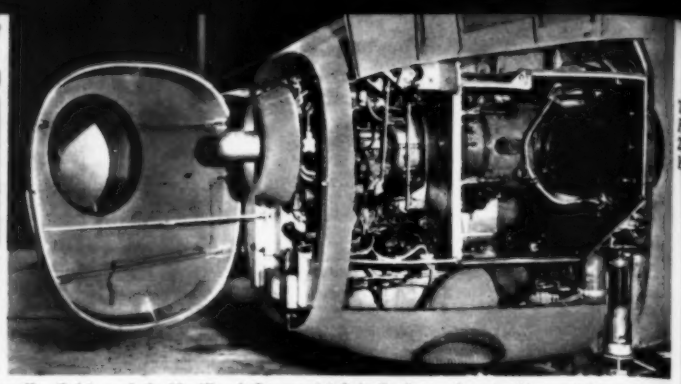
This picture of a ramp-equipped Boeing Vertol 107 gives a hint of future helicopter medium freighting possibilities

Igor Sikorsky and two of his colleagues rode draughtily on a rudimentary platform slung beneath the S-60 Skycrane. The outcome of their experiments was the 20-passenger "people pod" (below)

this breath-taking stroll, and the next morning a safety rail appeared on the platform! A more elaborate result of the experiment was the now-familiar 20-passenger "people pod" which has been demonstrated under the S-60 (picture: lower right).

Mr Sikorsky sees a big future for such pods. In his MIT lecture he said: "Comfortably-outfitted pods could be loaded with passengers and their luggage in the heart of a city and delivered by a crane-helicopter to a long-distance jet airliner, waiting at the end of a runway, where the passengers could be transferred comfortably and quickly." He went on to visualize a 24-passenger high-speed jet airliner—perhaps even a supersonic one—waiting on a roof-top platform in a city centre. A crane-helicopter would pick it up, lift it to one or more thousand feet, meanwhile accelerating to a speed of, say, 120 m.p.h. It could launch the airliner less than a minute after it left the platform. Upon arrival at destination, the procedure would be reversed.

Fantastic? That's what many "experts" said about helicopters as a whole not so long ago. Before scoffing let us take a look at the majority of the successful helicopters flying in the world today and remind ourselves how closely they follow the layout of a little prototype that was flown successfully just 20 years and eight months ago by a man named Igor Sikorsky.



Two outstanding production engines are the Napier Gazelle (left) and de Havilland Gnome (right). Both are free turbines with rear drive

HELICOPTER POWERPLANTS

IT is not unfair to assert that during the first 20 years of its existence (reckoning from the pioneer VS-300 of 1940) the world's helicopters have been held in check by their powerplants. Although piston engines have been taken to a high pitch of development, and in certain installations have enabled helicopter firms to produce outstanding vehicles, it is no exaggeration to say that the introduction of the turbine has brought about a revolution in helicopter performance. At one stroke it has enormously increased available power from a given bulk of powerplant, effected a slashing reduction in installed weight, and, while dispensing with cooling fans entirely, has removed the problem of engine overheating in adverse conditions at zero forward speed. A significant incidental advantage of the free-turbine engine is that it can drive without using a clutch.

Of the piston engines remaining in production the most notable examples are the British Alvis **Leonides** 570 h.p. radial and its 14-cylinder counterpart the 795 h.p. **Leonides Major**; the excellent Russian **ASh-82** series of from 1,430 to 1,700 h.p. and the American Pratt & Whitney **R-2800** of 2,100 h.p. and the 305 h.p. Lycoming **VO-540** flat-six. The last stronghold of the helicopter pistol engine is in the smallest sizes, and typical units are the Johnson 35 two-stroke (38 h.p.), three-cylinder **ILO** (40/50 h.p.), Nelson **H-63B** (43 h.p.), Porsche **70/2** (62 h.p.), and flat-four McCulloch **4318E** (72 h.p.).

Nevertheless, even in the small-helicopter field the turbine is ousting the piston engine, and much may be hoped from the Allison **250** and Boeing **520**. As the T63, the former is under intensive development for the American Services, and it is also likely to command a large commercial market. Weighing some 95lb, it delivers 250 s.h.p. at up to 100°F ambient conditions. Careful design is expected to combine a specific consumption of 0.7 at full power with a selling price of the order of $6,000. The new Boeing engine employs a double-sided centrifugal compressor of such advanced design that it can operate at a pressure ratio of 6.5 : 1. Under development for the US Navy as the T60, the helicopter version is at present giving 400 s.h.p. for a weight of 325lb; the more advanced 520-6 will weigh only 260lb yet will deliver a minimum military output of 525 s.h.p. with s.f.c. of 0.65. The -6 is expected to be commercially available before 1964.

In roughly the same power class is the Canadian Pratt and Whitney **PT6B-2**, which will weigh 225lb and be rated at 500 s.h.p. with s.f.c. of 0.71. Prototypes may be available next year at a price of something like $15,000. Turboméca have delivered over 700 **Artouste 2B1** single-shaft, 400 h.p. engines for Alouettes and have made a small number of the more efficient 542 h.p. 3B version. About 370 **Palouste** air compressors have been made for Djinns, but no new tip-drive application is in prospect. The most important new Turboméca engine is the free-turbine **Turmo 3B**, three of which are geared to the single rotor in the big Frelon helicopter One of the latest of the company's axial/centrifugal family, the 3B is rated at 812 s.h.p. with s.f.c. of 0.67, and it weighs 560lb fully equipped. Production Frelons will have the Turmo 3C, rated at 900 s.h.p. at up to 100°F.

Blackburn's **Turmo** weighs 275lb and in the Saro P.531 Mk 0 is rated at 400 h.p. Blackburn's new engine is the excellent **Nimbus**, originally known as the A.129, which is being developed under contract to the MoA. As the powerplant of the Wasp Mk 1 it is derated to 650 s.h.p. and will maintain this power under any ambient conditions which might be expected. A complete simulated type-test to the new schedule has been completed, and when fully rated the Nimbus will deliver well over 1,000 s.h.p. with s.f.c. below 0.68. Dry weight is 390lb and the selling price is estimated at "£10 per horse power"—a competitive figure.

Chief competitor of the Nimbus is the de Havilland **Gnome**, British version of the General Electric **T58**. Both the British and American engines have the same 10-stage axial compressor with four rows of variable stators, and the bare basic power section weighs only about 250lb. Both firms are actively engaged in developing this excellent engine towards 2,000 h.p. and de Havilland have also produced the Coupled Gnome rated at 2,200 h.p. The initial 1,000 h.p. unit for RAF Whirlwinds will enter service with an overhaul life of 400hr, and is priced at something short of £15,000. One of the best helicopter engines in America is the Lycoming **LTC1**, now in production as the T53 for a variety of helicopters, two of which—the USAF Huskie and Army Iroquois—are being bought in great quantity. This free-turbine unit weighs 425lb and is rated at 700/960 h.p. with s.f.c. of 0.696.

A somewhat larger engine with roughly the same basic layout is the Napier **Gazelle**, which is perhaps the most important helicopter powerplant in Britain. The initial production version has an inwards-radial intake, weighs about 830lb with full equipment and can run in any attitude. Two Gazelle 101s, each with a 2½min rating of 1,650 s.h.p., are installed in the Belvedere; the Wessex Mk 1 has a single Gazelle 161, with a 1hr rating of 1,465 s.h.p. Both aircraft are next month to undergo tropical trials in Libya, and the Wessex will start Arctic testing in the autumn. The Gazelle has completed a full icing programme in Canada, and was the first British engine to complete these trials at the first attempt. Napier have now evolved the Gazelle 512, with a high-speed output shaft and a weight of only 675lb. In most installations this engine would have an axial intake and it may be fitted with single or quadruple exhaust ducts. The intake is fitted with Napier Spraymat heated panels, and although the accessories are carried around the intake they are driven from the front of the compressor shaft through two pairs of bevel gears. To permit higher temperatures, the first- and second-stage turbine blades are respectively of G67 and Nimonic 105, and the 5min and 30min ratings are both 1,640 s.h.p.

A rather more powerful free-turbine engine is the Lycoming **LTC4**, which is in production as the T55-L-5 for the US Army's big Boeing-Vertol Chinook. Originally planned to give about 1,500 h.p. it now has a military rating of 2,200 h.p. with s.f.c. of 0.595 and has already given over 2,500 h.p. on the bench. An even more powerful engine, being developed for the US Navy, is the General Electric **T64-GE-2**. Like the smaller T58 it has very advanced design points, and its pressure ratio of 12.5 : 1 brings the s.f.c. down to 0.506 at the maximum rating of 2,650 s.h.p. and to even lower values at partial power. Weight is 854lb and two may be used in the Sikorsky S-64.

Napier's **Eland** single-shaft engine has logged well over 1,200hr as the powerplant of the prototype Rotodyne and the Eland 229 is at present flying in the hub-driven Westminster. Production Westminsters would have the Eland 221, with a 2½min rating of 3,500 h.p. At the time of writing the two most powerful helicopter powerplants are the Rolls-Royce **Tyne** for the Westland (Fairey) Rotodyne and the Soviet **TB-2BM** which powers the Mi-6. Both are high-pressure free-turbine engines, and their respective ratings are 5,250 and 4,700 s.h.p. The Russian helicopter has a straightforward mechanical transmission system to the rotor shaft, but the Rotodyne engine is virtually a complete turboprop together with a hydraulic clutch to an auxiliary rear compressor feeding air to the pressure jets on the rotor.

Although capable of over 1,000 h.p., the Blackburn Nimbus is limited to 650 s.h.p. in the Westland (Saro) Wasp, in which it is here installed. Its development, to MoA contract, is progressing well

"Flight" photograph

HELICOPTERS OF THE WORLD

(Continued from page 718)

conjunction with a four-blade tail rotor on the starboard side. Civil versions as well as military are in prospect, and the type should enter service later this year. Gross weight is generally considered to be at least 70,000lb.

Yakovlev

Yak-24 As reported last year, helicopters of this type now have a redesigned tail, differing from the former layout in having end-plate fins. It can also be reported that even later models have metal fuselage covering, whereas in the earlier versions the centre portion was fabric-covered and only the extremities had metal panelling. One version with the new fuselage is the Yak-24K, a civil transport aircraft believed to be already in service with Aeroflot. A new, 75ft, rotor is reported.

The Yak-24 is powered with two 1,700 h.p. ASh-82V 14-cylinder radial engines, driving rotors similar to those of the Mi-4. Combined with the rear section of the fuselage, in military models at least, is a loading ramp for wheeled or tracked vehicles and heavy military equipment. The cabin measures some 33ft in length and will accommodate two lorries or jeeps, a twin 14.5mm anti-aircraft gun with its crew, or as many as 40 troops with service equipment.

● Rotor diam, 68ft 11in; gross weight, 32,000-36,000lb; cruising speed, over 120 m.p.h.

U.S.A.

Adams-Wilson Helicopters Inc

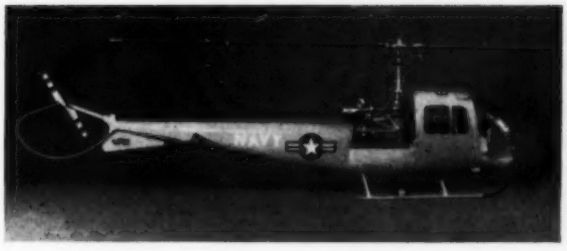
Box 6042, Lakewood, California

HobbyCopter Numerous amateur constructors have paid their $35 for the plans of this single-seat helicopter, and the makers are also offering it in kit form. It is an uncertificated aircraft; therefore it may be built and flown under the experimental category and must be proved airworthy by the homebuilders' local CAA safety agent. The engine is a 650 cc Triumph motor cycle unit of 40 h.p. driving a two-blade main rotor of solid spruce.

● Rotor diam, 21ft 6in; fuselage length, 14ft; empty weight, 355lb; gross weight, 555lb; est. top speed, 60 m.p.h.; est. ceiling, 8,000ft; est. range, 120 miles.

Bell HU-1A Iroquois carrying Nord missiles

Bell HUL-2



Bell Helicopter Corporation

PO Box 482, Fort Worth, Texas

HU-1A Iroquois (Model 204) Very-large-scale production of this turbine-powered helicopter is under way for the US Army. All components have been designed for a minimum of a thousand hours of operation between overhauls. A low silhouette places the cabin floor at knee height, permitting ease of loading of cargo or passengers. Wide sliding doors give quick access to the passenger/cargo area and separate doors open to the crew positions. The sling for carrying external cargoes is attached at the c.g. so that load oscillations, excited aerodynamically, and attitude changes in flight are dynamically independent of each other. Feed-back forces between the external load and the helicopter, the makers claim, are prevented, and the need for continual control corrections is eliminated. Normal seating is for six, but the 8ft-wide cabin is quickly convertible for ambulance work, with provision for four stretcher patients with attendant. Provision is made for more than 2,000lb of armament, including rockets and machine guns. The engine is a Lycoming T53-L-1 free-turbine derated to 700 s.h.p.

● Rotor diam, 44ft; fuselage length, 39ft 7in; gross weight, 5,800lb; cruising speed, over 110 m.p.h.; best rate of climb, over 2,000ft/sec; hovering ceiling in ground effect, over 14,000ft; range, over 210 miles.

Models 47G-2 and 47G-3 (Trooper) These are the latest commercial versions of the 47 series to be placed in production. The G-2 has a Lycoming 250 h.p. engine de-rated to 200 h.p. and the G-3 has a Franklin turbo-supercharged engine of 225 h.p.

The standard cabin layout includes a full-width seat for pilot and two passengers; hydraulic controls are another standard fitment. A drum-and-cable tail rotor control system is claimed to simplify maintenance. The 1960 Model 47G-2 has metal main rotor blades, improved ventilation and defogging, and a new heavy duty tail rotor gearbox.

Equipped with skid landing gear and the new metal blades the G-2 is priced at $40,500. The G-3, similarly equipped, costs $44,500.

The following data apply to the 1960 G-2:—

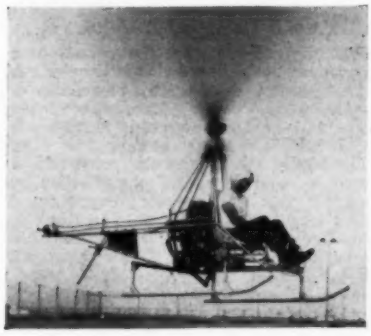
● Rotor diam, 35ft 1in; fuselage length, 27ft 4in; empty weight, 1,564lb; gross weight, 2,450lb; max speed, 100 m.p.h.; cruising speed, 85-93 m.p.h.; service ceiling, 12,300-17,500ft; hovering ceiling in ground effect, 10,850-16,250ft; range, 238-253 miles.

Model 47J-2 Ranger The J-2 is the latest of the Ranger series and is powered with a Lycoming VO-540-B1B engine de-rated to 240 h.p. Essentially the "J" series differs from the "G" in being a four-seater. It can be supplied with standard or de luxe passenger interiors, and equipped with metal main rotor blades and 49 US gal fuel tanks and a skid undercarriage, it is priced at $72,500.

HUL-2 Of the very numerous military and naval variants of the Bell 47 range, this forthcoming aircraft calls for particular mention in that it will be powered with

Bell 47G-2 Trooper

HobbyCopter



Bell 47J Ranger

Bensen B-8M Gyro-Copter

Bensen B-9 Little Zipster

Brantly B-2

HELICOPTERS OF THE WORLD . . .

the Allison YT63-A-3 turboshaft engine of 250 h.p. Like the HUL-1, the current US Navy version of the 47J, it will be used for reconnaissance, patrol, rescue and general utility work. A four-seater, it will have metal rotor blades. It is estimated that the hovering ceiling will exceed 15,000ft, that the maximum rate of climb will be more than 1,300ft/min, and the vertical rate of climb more than 1,000ft/min.

empty weight, 247lb; normal gross weight, 500lb.

B-9 Little Zipster The Little Zipster, unlike the Gyro-Copter, is a true helicopter. The makers' promotional literature reads: "Ready-to-fly fully assembled B-9 'copters are priced for export at $6,995—F.O.B. factory. One can build a B-9 for a fraction of this cost in the US from factory-supplied kits and plans. Basic construction drawings sell for $5.00. Until it is 'type certificated' by FAA, the Little Zipster will not be sold in US ready-made except to qualified buyers for purposes acceptable to FAA. Operating cost runs between $3 and $5 per hour, depending on location—approximately the same as operating an outboard powered boat."

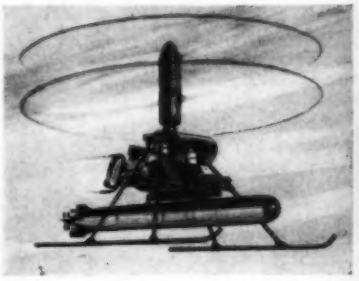
The engine is a Mercury MK 78 liquid-cooled two-stroke of 70 h.p. and controls are generally the same as those on the Gyro-Copter. It is claimed that an average person who can ride a bicycle can check himself out in the Little Zipster in about three hours.

● Rotor diam, 20ft or 22ft; length, 11ft 3in; empty weight, 450lb; normal gross weight, 700lb; cruising speed, 60 m.p.h.; max speed, 80 m.p.h.; speed for max economy, 35 m.p.h.; service ceiling, 11,000ft; hovering ceiling in ground effect, 6,000ft; max rate of climb, 900ft/min; max range, 100 miles. (All figures are preliminary.)

Doman Whippet

Cessna CH-1C

Doman LZ-5-2



Gyrodyne DSN-1

Hiller YROE-1

Bensen Aircraft Corporation

PO Box 2746, Raleigh, N.C.

B-8M Gyro-Copter The Gyro-Copter is offered for amateur construction. The makers claim that it can be built for as little as $400-500, using surplus materials available on the used-aircraft market. Plans "tailored to the skills of an amateur builder" sell for $25. The engine is a McCulloch 4318E four-cylinder air-cooled two-stroke giving 72 h.p. driving a pusher propeller. Cyclic pitch is by an overhead azimuth stick or by a joystick, and there is no collective pitch control. Yaw control is by rudder and nosewheel steering, and the throttle is a twist-grip on the left handlebar. The two-blade rotor is of laminated plywood construction, with a steel spar.

The capabilities of the aircraft are manifest in the first two phases of the demonstration schedule as laid down by the makers. This schedule begins: "(1) Take-off and slow flight, about 25 m.p.h., before spectators and cameras. Slowest level flight is about 14 m.p.h., but the craft can be slowed down to 0 speed and even flown backwards at the expense of losing some altitude. (2) High speed flight. Top speed up to 100 m.p.h. can be attained with the engine wide open. Normal cruise speed is 60 m.p.h., 'high cruise' is 85 m.p.h. Maximum economy cruise is 45 m.p.h. Range is about 100 miles."

● Rotor diam, 20ft; fuselage length, 11ft 4in;

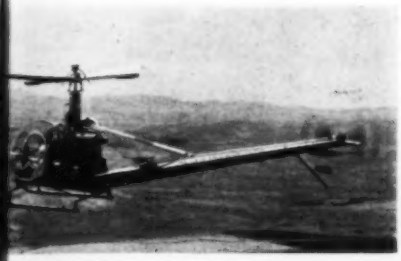
Brantly Helicopter Corporation

24 Maplewood Avenue, Philadelphia 44, Pa

B-2 The B-2 is offered expressly as a private-owner or executive helicopter. A side-by-side two-seater, it is powered with a Lycoming VO-360-A1A engine of 180 h.p. and has an interesting three-blade rotor with a diameter of only 23ft 11in. The blades are of all-metal construction, with a solid extruded aluminium-alloy leading edge and combined flapping and drag hinges near mid-span. In the rear fuselage is a baggage compartment of 6 cu ft which will take 50lb weight.

● Rotor diam, 23ft 11in; fuselage length, 19ft 4in; empty weight, 980lb; gross weight, 1,600lb; max speed, 100 m.p.h.; rate of climb

Gyrodyne YRON-1s



Hiller 12E

Hughes 269A

Kaman K-17

at s.l., 1,580ft/min; range, 300 miles (plus reserve).

Cessna Aircraft Company

Wichita, Kansas

CH-1C Since this attractive helicopter was described last year it has been on tour of military commands and several additional evaluations are planned in the near future. Announcing certification by the FAA the makers claimed that chief among the CH-1C's qualities was inherent stability without dependence upon electronic stabilizing devices. This stability, they said, was comparable to that of a fixed-wing aircraft. A four-seater, the CH-1C has a Continental FSO-526A engine of 260 h.p., located forward of the cabin section. A single two-blade metal main rotor is employed. In executive form the aircraft appears to be a worthy stable companion of the Cessna fixed-wing range.

● Rotor diam, 35ft; fuselage length, 32ft 8in; empty weight, 2,065lb; gross weight, 3,100lb; max speed, 122 m.p.h.; cruising speed, 100-120 m.p.h.; hovering ceiling in ground effect (2,700lb), 13,500ft; range, 267 miles.

Kaman HU2K

Doman Helicopters Inc

Danbury, Conn

LZ-5-2 Although the makers have failed to furnish particulars of the latest developments in connection with this aircraft, a member of *Flight*'s staff who flew in it last year reported that it had many features to commend it to operators. "Perhaps the most attractive of these," he wrote, "is the totally enclosed self-lubricating rotor hub, mounting the four hingeless blades; control is effected by tilting the gimbal-mounted rotor-head. The six passengers occupy seats angled out towards the sizeable windows, and with seats removed the concertina doors on each side fold to give a completely unrestricted access for large items of cargo. The eight-cylinder Lycoming engine is inclined low in the nose, and drives via a shaft passing between the pilots up to the rotor-head. In the air the LZ-5 demonstrated great tractability, with sufficient reserve from an engine of only 400 h.p. Ground resonance was quite absent, and vibration in flight not excessive for a craft of this type."

● Rotor diam, 48ft; fuselage length, 38ft; empty weight, 3,250lb; gross weight, 5,200lb; max continuous speed, 100 m.p.h.; speed for best range, 81 m.p.h.; range (standard tanks), 486 miles.

Whippet To be marketed next year, the Whippet is a four-seater with a Lycoming VO-360 engine of 180 h.p.

● Gross weight, 1,940lb; max speed, 132 m.p.h.; speed for best range, 103 m.p.h.; rate of climb, 1,500ft/min; service ceiling, 15,000ft; range (with 15min reserve), 206 miles

Gyrodyne Co of America Inc

St James, Long Island, N.Y.

YRON-1 Rotorcycle Four distinct versions of the Rotorcycle have been developed and the makers distinguish these in the following terms:—

"*Version 1.* 17ft diameter rotor, powered by a four-cycle Porsche engine (YO-95-2) with a take-off rating of 62 s.h.p. net after cooling, standard sea-level conditions. This Rotorcycle is now being evaluated by the Marine Corps at Quantico, Va. Expected minimum life of the Rotorcycle between major overhauls—100hr. *Version 2.* 17ft diameter rotor, powered by a Solar T62 gas turbine engine rated at 62 h.p. standard sea-level conditions (based on transmission limitations). Flight testing of Rotorcycle is currently under way, and is scheduled for completion by early 1960. Expected minimum life of the Rotorcycle between major overhauls — 500-1,000hr. *Version 3.* 20ft diameter rotor, powered by a Porsche engine (YO-95-6) rated at 72 h.p. net after cooling, standard sea-level conditions. Development of Rotorcycle is complete and flight testing is currently under way. Expected minimum life of the Rotorcycle between major overhauls—1,000hr. *Version 4.* 15ft diameter rotor, 'ultra-light' version, powered by a Solar T62 engine rated at 62 h.p. on standard day. This model will be a revival of the first Rotorcycle built with the two-cycle engine. Expected minimum life of the Rotorcycle between major overhauls—500-1,000hr."

In addition, a twin-engined version, with a 20ft rotor, is under development, and testing of this model should be completed by the end of this year. The following data apply to Version 4 of the Rotorcycle:—

● Rotor diam, 15ft; empty weight, 300lb; gross weight, 530lb; vertical rate of climb, 1,840ft/min; max speed, 72 m.p.h.; typical range, 25 n.m. (Version 1 has a typical range of 51 n.m.)

DSN-1 This is a "drone" development of the basic Rotorcycle configuration. A series of these unmanned aircraft will be developed as the airborne elements in the DASH (destroyer anti-submarine helicopter) weapon system. By incorporating electronic equipment in place of the pilot the machine will perform an ASW function of great importance, operating from destroyers and returning, after the attack, to the mother ship.

Hiller Aircraft Corporation

Palo Alto, California

YROE-1 Rotorcycle The first of a batch of these small helicopters being built in Great Britain by Saunders-Roe was flown late last year. The Hiller company state that the type represents the minimum practical size in helicopters. It achieves a gross-to-empty weight ratio of about two—claimed to be a value unprecedented in mechanically driven helicopters. The engine is now a Porsche of 62 h.p., developed

HELICOPTERS OF THE WORLD . . .

specifically for the aircraft. Primarily the YROE-1 is being developed for military applications, although a civil version is in prospect. Of the military applications the makers remark: "Immediate intelligence and communications control can be initiated in the fluid combat situation and with minimum logistic effort by employing Rotorcycles for airborne surveillance and inspection, light wire laying, courier work, and as an airborne communications station. Rotorcycles may also be used to transport small but critical re-supply items and equipment; folded within a streamlined pod, it may be air dropped from the lightest of military aircraft as a rescue or evacuation vehicle; used in force, assault troops and patrols can move unannounced into strategic enemy areas."

● Rotor diam, 18ft 6in; empty weight, 300lb; gross weight, 496lb; max speed at s.l., 70 m.p.h.; cruising speed, 52 m.p.h.; max rate of climb at s.l., 1,160ft/min; hovering ceiling in ground effect, 9,200ft; range at s.l. with 170lb pilot, 166 miles.

12E Having a military counterpart in the H-23D Raven, the civil 12E is built to accommodate kit conversions for a ten per cent increase in horsepower and a cabin configuration kit conversion from three to four seats. The engine is a Lycoming VO-540 of 305 h.p. Equipment can include dual controls, quick-release cargo sling, hoist, stretchers, spray gear and flotation gear.

● Rotor diam, 35ft 6in; fuselage length, 27ft; empty weight, 1,700lb; gross weight, 2,700lb; max speed at s.l., 95 m.p.h.; cruising speed for max range, 82 m.p.h.; max rate of climb, 1,520ft/min; hovering ceiling in ground effect, 9,500ft; range, 185 miles.

Hughes Tool Company

Culver City, California

269A This little helicopter is being offered at $22,500. The makers claim that it requires half an hour of maintenance per flight-hour, uses 8-10 US gallons of fuel per flight-hour, and gives at least 1,000 hr life for all wearing parts in all major components. A main rotor blade, they say, can be bought for less than $250. The Lycoming O-360 engine of 180 h.p. is installed beneath the two seats, and a vee-belt drive eliminates the need for a clutch.

● Rotor diam, 25ft; length, 28ft; empty weight, 867lb; gross weight, 1,550lb; cruising speed, 85 m.p.h.; range, 200-220 miles; hovering ceiling in ground effect, 6,000-13,500ft.

Kaman Aircraft Corporation

Bloomfield, Conn

HU2K-1 Seasprite A utility, and possibly anti-submarine, helicopter for the US Navy, this advanced aircraft has a General Electric T58-6 turbine of 1,025 s.h.p. A remarkable feature is the retractable undercarriage, which is intended not only to benefit speed but to avoid the possibility of the cable being tangled on rescue operations.

Describing the HU2K-1 our contemporary *Aviation Week* reports: "A virtually all-new helicopter, the HU2K embodies few components from previous Kaman aircraft. Key design features are: all-aluminium construction, aluminium and glass fibre rotors, fully retractable landing gear, flotation hull, maintenance provisions and a sophisticated avionics system designed for in-flight operating simplicity. The virtually all-aluminium fuselage is of semi-monocoque design with a tub type flotation hull. Chief structural member is a built-up, beaded-aluminium sheet centreline keel running aft to the pylon extension, separating the cabin deck from the belly to form a two-foot-deep flotation chamber that also houses main fuel tanks."

The manufacturers have developed their own automatic stabilization equipment and dead-reckoning navigation equipment for this helicopter in order to provide maximum flexibility in rescue work, all-weather operation and anti-submarine warfare. When coupled, the autostabilization equipment and "autonavigator" provide complete hands-off control.

● Rotor diam, 44ft; overall length, 52ft 2in; empty weight, 5,052lb; max gross weight, 9,152lb.

K-17 This experimental aircraft is a gas-turbine-powered, cold cycle, tip-jet helicopter. The turbine runs a compressor, and compressed air is passed through the rotor-tips. The system is thought to hold promise of "an answer to the need for simplicity." The company is employing the helicopter as a testbed in conjunction with the evolution and development of jet rotor propulsion. The engine is a Turbomeca Turmo of 400 e.s.h.p.

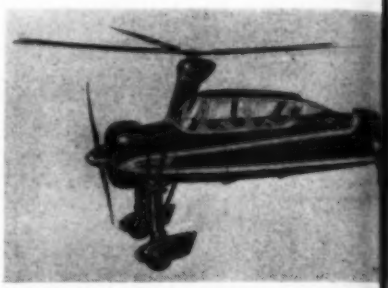
McDonnell Model 120 lifting another

● Rotor diam, 35ft; empty weight, 950lb; gross weight, 2,000lb; max speed, 80 m.p.h.

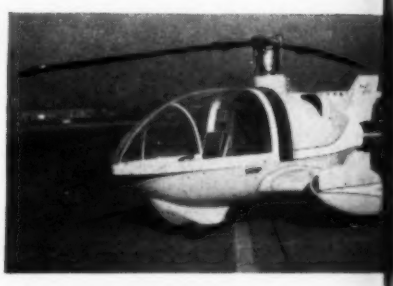
H-43B Huskie Powered with a Lycoming T53 turbine of 825 s.h.p., the Huskie is primarily intended for crash-rescue missions. It features several well-known Kaman developments, including servo-flaps, intermeshing rotors, and in-flight tracking. Servo-flaps are small aileron-like controls mounted behind the rotary wings. They make possible lighter, more sensitive control as well as greater stability. The intermeshing rotors permit a symmetrical design in which torque is inherently equalized and balanced. All of the power of the engine can be translated into lift. In-flight tracking is a Kaman-developed system that enables the pilot to track either rotor by a simple switch in the cockpit.

A production Huskie has established an

Kaman H-43B Huskie



Kellett KD-1



Monte-Copter Model 15 Tri-phibian

Omega BS-12

Rotorwing Sportsman

Sikorsky S-56 (nearest camera), S-58 and S-55

Sikorsky S-60 Skycrane

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altitude record for helicopters in the 3,850-6,614lb weight category of 30,100ft.

● Rotor diam, 47ft; length, 47ft; empty weight, 5,900lb; gross weight, 7,100lb; max speed, 107 m.p.h.; hovering ceiling in ground effect, 20,000ft; normal range, 250 miles.

Kellett Autogiro Company

Box 35, Willow Grove, Pennsylvania

KD-1 Notwithstanding its "pre-war" layout, this autogiro is an aircraft of many attractions. A Jacobs R755-9 engine of 225 h.p. is standard and, as the illustration (an artist's impression) shows, the tandem cockpits are enclosed.

● Rotor diam, 40ft; length (blades folded), 26ft; empty weight, 1,500lb; gross weight, 2,200lb; max speed, 125 m.p.h.; take-off run (no wind), 200ft; rate of climb, 1,060ft/min; service ceiling, 14,000ft.

McDonnell Aircraft Corporation

St Louis 66, Mo

Model 120 A private-venture cargo helicopter, the Model 120 is pressure-jet driven and of unusual layout (see picture). Level flight can be maintained at maximum weight with one of the three AiResearch turbine compressors inoperative. The engines are mounted at shoulder height and it is claimed that they can be changed in five minutes without the use of any tools. Cargo is suspended from a pilot-controlled hook immediately below the rotor; alternatively, twelve persons can be accommodated on "toboggan seats" which attach to the crossmember supporting the cockpit and a similar aft member which is part of a "personnel kit." This kit will contain an enclosure to protect the occupants from wind and downwash.

● Rotor diam, 31ft; empty weight, 2,450lb; gross weight, 6,300lb; max speed, 138 m.p.h.; hovering ceiling in ground effect, 12,000ft; normal range, 98 miles.

Monte-Copter Inc

Boeing Field, Seattle 8, Wash

Model 15 Tri-phibian This amphibious helicopter utilizes the cold-cycle pressure-jet rotor system. The air-compressor is a Continental 141—the American version of the French Palouste 4. As the illustration shows, the wing (stressed skin) provides outrigger stability as well as unloading the rotor. The fuselage has glass fibre skin and the cabin seats three people.

● Rotor diam, 36ft; length, 15ft 3in; empty weight, 1,230lb; gross weight, 2,000lb; max speed, 95 m.p.h.; range, 170 miles; service ceiling, 15,000ft.

Omega Aircraft Corporation

Municipal Airport, New Bedford, Mass

BS-12 The makers have communicated no new information on this twin-engined utility helicopter, which embodies a five-seat cabin forward and a large cargo area directly beneath the rotor centreline. Two Lycoming O-540-F1B5 engines are mounted externally.

● Rotor diam, 39ft; overall length, 48ft; empty weight, 3,300lb; gross weight, 4,750lb; max speed at s.l., 95 m.p.h.; economical cruising speed, 75 m.p.h.

Rotorwing Aircraft Company

PO Box 9113, Birmingham 13, Alabama

Sportsman Although initial production of this autogiro will be in America, it is also foreseen that production will eventually be shared by a subsidiary in the United Kingdom. The prototype has an 85 h.p. Continental C85, but an engine of 115 h.p. will be fitted in production models. Pilot and passenger sit side by side in the 42in-wide cockpit. The rotor blades are made of cedar and mahogany, with a steel spar, and the main undercarriage is of leaf-spring type. The first prototype flew in April this year and delivery of the first certificated production model is scheduled for next February.

● Rotor diam, 27ft 6in; fuselage length, 12ft; empty weight, 750lb; gross weight, 1,200lb; max cruising speed, 95 m.p.h.; stalling speed, 19 m.p.h.; service ceiling, 10,000ft; take-off run, 50ft; endurance, 4hr with 30min reserve.

Sikorsky Aircraft Division of United Aircraft Corporation

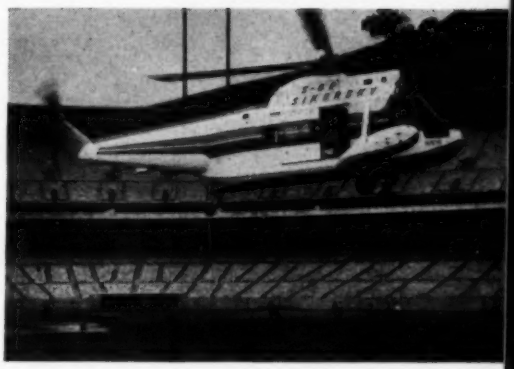
Stratford, Conn

S-56 The US Navy and Marine Corps know this helicopter as the HR2S and the US Army call it the H-37A Mojave. It can carry 36 fully equipped troops, with an alternative cargo capacity of 1,325 cu ft. There are clamshell doors in the nose, and vehicles can be driven up a ramp. Automatic stabilization equipment, semi-automatic blade-folding equipment, a retractable undercarriage, and a 10,000lb-capacity automatic touchdown-release cargo sling to carry external loads are features.

● Rotor diam, 72ft; fuselage length, 82ft 10in; empty weight, 20,690lb; gross weight, 31,000lb; max speed, 130 m.p.h.; cruising speed, 115 m.p.h.; rate of climb, 910ft/min; service ceiling, 8,700ft; hovering ceiling in ground effect, 4,500ft; range, 230 miles (with external tanks).

S-58 This is the helicopter from which Westland's Wessex has been developed. It is otherwise known as the HSS-1 (US Navy), H-34 Choctaw (US Army) and HUS-1 (US Marine Corps). Seating capacity is for pilot and co-pilot and 12-18 passengers; or alternatively eight stretchers or a 4,000lb load can be carried for 100

Sikorsky HSS-2



Sikorsky S-62

Umbaugh -18

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miles. Internal cargo capacity is 405 cu ft. A 5,000lb-capacity automatic touchdown-release cargo sling can carry external loads and provision is made for a 600lb-capacity hydraulically operated hoist. Military versions have automatic stabilization equipment. The rotor blades are all metal and the engine is a Wright Cyclone C989HE2 (1,525 h.p. for take-off).

● Rotor diam, 56ft; overall length, 65ft 10in; empty weight, 7,675lb; gross weight, up to 13,600lb; max speed, 123 m.p.h.; cruising speed, 98 m.p.h.; rate of climb at s.l., 1,100ft/min; service ceiling, 10,500ft; hovering ceiling in ground effect, 4,900ft; range, 260 miles.

S-60 Skycrane This "crane" helicopter utilizes the principal components of the S-56. Though piston-engined, it is regarded as the prototype of a whole family of turbine-powered cranes capable of carrying loads up to 50 tons. There is a cabin in the nose for the pilot and co-pilot. Several slinging points are located on the under-side of the fuselage and an experimental "passenger pod" has been developed.

● Rotor diam, 72ft; empty weight, 19,600lb; max gross weight, 34,500lb; hovering ceiling in ground effect, 6,800ft.

S-61 This autumn should see the first flight of the S-61—a boat-hull helicopter carrying up to 28 passengers and powered with two General Electric T58-8s of 1,250 s.h.p. max. The basic airframe is that of the HSS-2, later described.

● Rotor diam, 62ft; fuselage length, 58ft 11in; empty weight, 10,259lb; gross weight, 18,700lb; cruising speed, 135 m.p.h. at s.l.; range with max fuel, 285 miles.

HSS-2 Now in production for the US Navy as an anti-submarine helicopter, this amphibian, powered with two General Electric T58 shaft turbines, will, according to *Aviation Week*, have "nuclear depth bomb as well as conventional warfare capability." It will be capable of single-engine operation with full load. Anti-icing equipment is provided for the rotor blades and advanced submarine detection gear and an improved navigation system is installed. Points of note are the 600lb-capacity rescue hoist and the fully automatic blade-folding equipment for carrier stowage. A 6,000lb-capacity automatic touchdown-release cargo sling can be installed to carry external loads.

S-62 This was the first boat-hull amphibious helicopter to fly (1958). Essentially it embodies the mechanical components of the S-55 with gas-turbine power (one General Electric T58-GE-6 shaft turbine) and the new hull. Typical accommodation is for 10-12 passengers. The V bottom of the hull is designed to cushion impacts when alighting on water and to throw spray outwards and downwards.

● Rotor diam, 53ft; overall length, 62ft 3in; basic weight, 4,550lb; gross weight, 7,500lb; max speed, 117 m.p.h.; cruising speed, 98 m.p.h.; hovering ceiling out of ground effect, 8,000ft; service ceiling, 15,700ft; range, 230 miles.

S-64 A twin-engined crane helicopter, this type will have two General Electric T64s or Pratt & Whitney JT4s or Pratt & Whitney JT12s, driving a six-blade rotor of 72ft diameter. It will be capable of lifting at least eight tons.

Umbaugh Aircraft Corporation

Hagerstown, Md

Umbaugh-18 The address given above is, in fact, that of the Fairchild Engine & Airplane Corporation, which is now producing this little two-seat autogiro. It is intended to market the aircraft at $9,995 and it is said that maintenance cost will be about six cents a mile when the aircraft is flown 300 hours a year. The Lycoming 180 h.p. engine drives a pusher propeller and lift is provided by a three-blade rotor, the blades of which are pre-rotated for vertical take-off. Maximum speed is quoted as about 126 m.p.h. and cruising speed on 65 per cent power as 100 m.p.h. Range is about 350 miles and service ceiling 15,000ft.

Vertol Division, Boeing Airplane Company

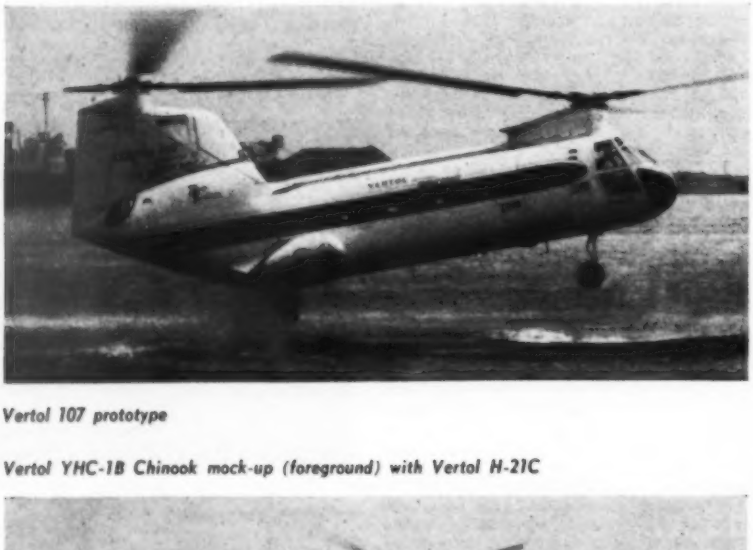
Morton, Penn

Model 107 A commercial forerunner of the US Army's much larger YHC-1B Chinook, the type has been adopted by New York Airways in a form which will differ from the prototype, which has been flying, as a private venture, since 1958. Full particulars of the production-type commercial 107 have not been given, but it is designed to cruise in excess of 150 m.p.h. with 25 passengers. At the time of writing there is still a possibility that, instead of General Electric T58 shaft turbines, the New York Airways' machines will have Napier Gazelles, installed in external pods. Fuselage length and all-up weight would be increased. The president of the American airline has said: "With these machines commercial revenues could for the first time offset all operating charges 'including taxes' and produce a fair return on the capital investment. This should be true on short-haul, high frequency routes where the service meets a public demand."

● Rotor diam, 50ft; fuselage length, 44ft 7in; empty weight, 11,000lb; gross weight, 18,400lb; max cruising speed, 150 m.p.h.; hovering ceiling (in ground effect), 7,800ft.

YHC-1B Chinook The first aircraft of this type should fly early in 1961. A mock-up is depicted. Powered by two Lycoming YT55 shaft turbines of 1,940 h.p., the Chinook is designed to have an average mission cruise speed of 150 m.p.h. There is a rear ramp-type opening as well as a forward door. There will be provision for carrying 33 combat troops or 24 stretcher patients. An auxiliary power unit will operate all the helicopter's systems (electrical and hydraulic) and there will be dual stability systems—the "universal automatic flight control system" developed by the Signal Corps and the Vertol developed "stability augmentation system." The loading ramp can be removed for flight to permit parachute dropping or free-drop delivery, or permit the transport of "over-length loads."

● Length (blades folded), 51ft; empty weight, 15,459lb; gross weight, 23,500lb; max speed, 175 m.p.h.; hovering ceiling (in ground effect), 12,900ft; service ceiling, 18,900ft; range (with reserves), 200 n.m.



Vertol 107 prototype

Vertol YHC-1B Chinook mock-up (foreground) with Vertol H-21C

Straight and Level

WE all know, and we've all said it so often, that London Airport North really is a national disgrace. The Ministry knows it, and there are some hard-working civil servants who deplore the fact that it took 2½ years for the new terminal plans to be approved, plans which themselves were years late being commissioned.

But we have to put up with the place for another year or two. So may I beg the Ministry to make it less of a scandal than it is?

The picture below (which comprises two joined-up snapshots) was taken by a *Flight* colleague. The people in the picture are passengers from three 707s, perhaps 300 of them at a conservative guess—maybe 400. The chaos was quite awful. The remarks being made by foreigners were really quite nasty.

No one knew where to find his baggage; there were only four Customs officers in attendance; and the general atmosphere, notwithstanding the courtesy of the Customs officers (when they could be got hold of), was: "You're now in Britain and we couldn't care less."

So come on, chaps—try to create a friendlier impression. Put up big posters apologizing for the temporary arrangements, display models or pictures of the new terminal, provide chairs for the old ladies and some rocking horses and see-saws for the toddlers (who, as we saw, can drive baggage-searching and Customs-queueing parents to distraction). And suggest to HM Customs, tactfully but firmly, that one officer per 75-100 people simply isn't good enough.

● This year the Royal Aeronautical Society's Orville Wright prize has been awarded to an engineer—who is not actually a member of the aircraft industry—for his papers entitled *Asymmetrically Plate-reinforced Circular Holes in a Uniformly End-loaded Flat Plate* and *Symmetrically-loaded Circular Plates under the Combined Action of Lateral and End-loading.*

Things, they say, have come a long way since the days of bamboo and canvas. The odd thought is that things still bust short of 100 per cent fully-factored design loads. Are we becoming too esoteric?

● Did you see the *Flight* photograph in last week's issue of a Comet 4 contrailing westwards over the North Atlantic, a 1,000 m.p.h. picture taken from a Boeing 707 flying eastwards at a height of 39,000ft?

The sky, heaven knows, is a very big place, and 2,000ft quadrantal height separations above 28,000ft make the possibility of collisions remote. (The Comet 4, though it doesn't look it from the picture, or from others taken during the five ensuing seconds, was presumably at 42,000ft.)

But the staff member who took the pictures confesses to a mild hand wobble as he put his camera away and resumed his dinner. The Comet *seemed* to have been at the same height; and though lateral separation was appreciable, what navigator (he asked himself) can hold a track to within half a mile with present navigation equipment?

If that thing had come through the cabin it would, as Capt Adkins of collision-light fame once remarked, have ruined his day. One just hopes that someone, somewhere, had both aircraft in full control.

● Though Blue Streak's cancellation was largely on technical grounds, the technical decision was taken in the warm, euphoric atmosphere of the approach to the summit.

If the same technical decision had to be taken now, would Blue Streak still be cancelled? Are we right to lean so heavily on the deterrent of our American allies, whose pre-summit U-2 tactlessness so disturbingly shook British confidence in American diplomacy and judgment?

These are profoundly difficult questions. No doubt there will be many opinionated attempts to answer them. For my part I freely admit that I do not know the answers.

There can be no change in the technical arguments for cancelling Blue Streak. But I somehow feel that the technical arguments appear less weighty when considered in the bitter cold of the post-summit atmosphere. Let's face it: the cancellation of Blue Streak was at least partly a political decision. And the political circumstances in which that decision was taken are now rather different.

● There was something particularly poignant in Dr Horace King's contribution to the adjournment debate in the House of Commons last week on the Transair DC-3 accident (see p. 739):—

"One of the victims of the tragic crash was the brilliant young daughter of one of my closest personal friends. Mary Cotton was the head girl of her school, an outstanding athlete, the winner of the open university scholarship and a brilliant young medical student on the threshold of a great career. Her death, like that of her student companions, was a grievous loss to her native town and to her country."

Accident statistics are cold and impersonal, and they can be juggled by experts to prove almost anything. Dr King's tribute to Mary Cotton reminds everyone of what accidents *really* mean, and I think he has thereby made a contribution to air safety.

● I cannot help feeling sorry for the Canadian firm of Aviation Electric. Their vice-president, D. R. Taylor, is to read a paper at the a.g.m. of the Canadian Aeronautical Institute. Its title: *Short Run Production Problems.* Could someone ship a few copies over here, please?

● "Of course, he was a fool to come down as low as 68,000ft."—USAF senior officer.

ROGER BACON

Shambles at the shantytown: a picture taken in the Customs hall of London Airport North at about 10.30 p.m. on May 12 (see first item)

On May 6 Maj Robert A. White, USAF, made the 28th X-15 flight from Edwards Air Force Base (the complete log of X-15 flights is given in the table below). Here a maintenance check is being performed on the aircraft, which is 56-6670, the first of its type

Missiles and Spaceflight

PROGRESS WITH THE X-15

The table reproduced below gives the complete flight history of the first two North American X-15 research aircraft at Edwards Air Force Base, California, up to May 6. Above is shown a photograph of the first of these aircraft; the second broke its back on November 5 last but was repaired and flying again by the beginning of February. The three pilots who have flown the aircraft to date are Scott Crossfield of North American, Joseph A. Walker of the National Aeronautics and Space Administration, and Maj Robert A. White, USAF.

Each of the two aircraft has been powered by two Reaction Motors XLR 11 rocket engines for all the flights listed. Later the more powerful XLR 99 will be fitted, the specifications for which include: thrust, over 50,000lb, throttleable; propellants, liquid oxygen and liquid ammonia; propellant flow rate, over 10,000lb/min; tank pressurizer, helium; turbopump driven by decomposed hydrogen peroxide.

—AND WITH DYNA-SOAR

Brig-Gen John W. Carpenter III, commander of the US Air Force Flight Test Center at Edwards Air Force Base, told journalists on May 6 that the Dyna-Soar programme represented a "quantum" jump beyond the X-15, and that he was already planning pilot training activities for Dyna-Soar.

"Our specific responsibility for Dyna-Soar here at AFFTC is the selection and training of pilots for the programme," he said. "We will not select a given number of pilots as we have done for experimental aircraft in the past. We will attempt to produce a pool of pilots from which we can choose test pilots not only for

Flt No	Date	Type Flight	X-15 No	Pilot	X-15 Drop.Land	Purpose and Remarks
	1959					
1	10/3	Captive	1	Cross-field	No drop	Aerodynamic and system checks; crew familiarization; power loss between B-52 and X-15. 38,000ft. M0.8.
2	1/4	Captive	1	Cross-field	No drop	Check compatability of B-52/X-15. Communications failure. Loss of cooling flow to pilot's suit. Glide aborted.
3	10/4	Captive	1	Cross-field	No drop	Functional checks of sub-systems to 45,000ft and M0.8. APU failure. Glide aborted.
4	21/5	Captive	1	Cross-field	No drop	Operational checks at 38,000, 30,000, 20,000ft. Cooling liquid nitrogen supply depleted. Glide aborted.
5	8/6	Glide	1	Cross-field	0840 0845	1st glide flight completed. Launch at 37,700ft at M0.8. Touchdown 145kt; run-out 4,800ft. Successful.
6	24/7	Captive	2	Cross-field	No drop planned	1st full-fuel mated flight. Successful.
7	4/9	Captive	2	Cross-field	No drop	2nd captive flight fully loaded with propellants. Aborted power drop 6 mins prior to launch—X-15 lox tank pressure variation.
8	17/9	Power	2	Cross-field	0808 0817	1st powered flight completed. Drop at 38,000ft. Max. M2.3. Touchdown 180kt. Ground roll 1 mile.
9	10/10	Captive	2	Cross-field	No drop	Powered flight aborted —B-52 lox top-off tank pressurization malfunction.
10	14/10	Captive	2	Cross-field	No drop	Powered flight aborted. Lox top-off and X-15 cockpit pressurization difficulties.
11	17/10	Power	2	Cross-field	1013 1023	2nd powered flight completed. Max altitude 65,000ft. Max speed M2.3.
12	22/10	Captive	2	Cross-field	No drop	Powered flight aborted —breathing-oxygen selector malfunction. X-15 windshield frosted.
13	31/10	Captive	2	Cross-field	No drop	Powered flight aborted —cloud cover in flight path.
14	5/11	Power	2	Cross-field	0939 0944	3rd powered flight. Emergency landing on Rosamond Dry Lake. Explosion and fire in lower engine area. X-15 fuselage broke at equipment bay.
15	16/12	Captive	1	Cross-field	No drop	Powered flight aborted —low lox tank pressure in X-15.
	1960					
16	23/1	Power	1	Cross-field	1617 1627	4th powered flight, 1st on 670. Landing North lakebed. Late take-off due telemetering. Max. alt. 65,000ft. Max. M2.
17	4/2	Captive	2	Cross-field	No drop	Powered flight aborted —loss fuel tank pressure and helium-source pressure.
18	11/2	Power	2	Cross-field	1016 1026	5th powered flight. Landing North lakebed. Max. alt. 86,000ft. Max. M2.15.
19	17/2	Power	2	Cross-field	0942 0953	6th powered flight. Max. alt. 50,000ft. Max. M1.6. Lost upper engine after 200.2 sec.
20	17/3	Power	2	Cross-field	0830 0839	7th powered flight completed. Max. alt. 50,000 ft. Max. M2.1. Manoeuvrability investigation.
21	18/3	Captive	2	Cross-field	No drop	Power flight aborted 1 min. to launch—broken fuel prime line.
22	25/3	Power	1	Walker	1541 1550	1st powered flight for NASA/AF phase of programme; 8th powered; 2nd on 670. Alt. 48,500ft. Max. M2.0.
23	29/3	Power	2	Cross-field	0957 1006	9th powered flight. Max. alt. 50,000ft. Max. M2.0. Cold soak flight to simulate a Wendover launch.
24	31/3	Power	2	Cross-field	0839 0848	10th powered flight. Max. alt. 50,000ft. Max. M2. Purpose, 3½-5g pull-outs.
25	13/4	Power	1	White	0913 0922	1st Air Force flight in programme, 1st for Maj. White. Pilot familiarization. Max alt. 50,000ft. Max. M2.0.
26	19/4	Power	1	Walker	0852 0902	2nd flight for Walker. Max. alt. 60,000ft. Max M2.6 (1,700 m.p.h.).
27	5/5	Heavy weight captive	2	Cross-field	No drop	Powered flight aborted —technical difficulties.
28	6/5	Power	1	White		Stability checks and pilot familiarization. Max. alt. 60,000ft. Max. M2.3.

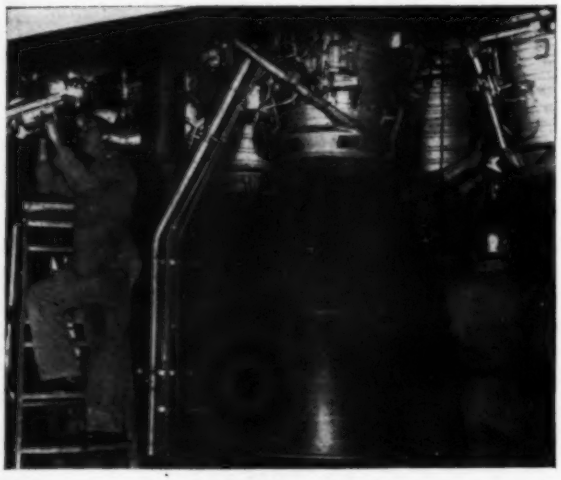
Dyna-Soar but, later on, for follow-up vehicles which surely will follow Dyna-Soar just as Dyna-Soar is following the X-15."

US LAUNCH-VEHICLES DESCRIBED

Delivering an address, *Rocket Power—Key to Space Supremacy*, before the American Rocket Society at Los Angeles on May 10, Maj-Gen Don R. Ostrander, Director of Launch Vehicle Programs, National Aeronautics and Space Administration, outlined the US programme of present and future rocket vehicles for space research. The overall philosophy behind the programme, he said, was based on three precepts: "First, we are creating a standardized fleet of trucks, if you want to call it that, with a minimum number of different types in the fleet; second, we propose to attain reliability through repetitive use of the vehicles in our fleet; and third, to avoid early obsolescence, we want to insure that each new vehicle we develop incorporates the most advanced technical approaches and growth potential consistent with the reliability we require."

The programme itself was described as follows: "We are still limited to the launch vehicles with which the US began its space program, or their direct descendants. A few have been retired—the Jupiter C which served us so well back in 1958 when we so greatly needed a US satellite in orbit to repair, in some measure, our badly mauled prestige; and the Vanguard which, in spite of its troubles, more than earned its development cost in the information provided by the three scientific payloads it orbited. In addition, it paid dividends by giving us upper stages for the Thor-Able, the Thor-Delta and the Scout.

"Also due to be retired this year is the Juno 2, based on the Jupiter IRBM and the Thor-Able. The Thor-Delta, which is a



The second test of all eight engines of the Saturn first stage took place at the Marshall Space Flight Center, Huntsville, on May 17. A thrust of 1,300,000lb was developed for 30sec. This photograph shows adjustments to individual engines being made in preparation for an earlier test (see news-item "US Launch Vehicles Described").

Thor-Able improved through the addition of coasting-flight attitude control and the accurate and flexible Titan radio-guidance system, will be used through 1961 in a 12-vehicle program, but no follow-on procurement is planned.

"All of these vehicles are destined to be replaced by two vehicles, the Scout and the Thor-Agena B—the Scout because of its relatively low cost, which is about $750,000 per copy including all launching costs, and its high reliability potential; and the Thor-Agena B because of its combination of greater payload, flexibility of operation, and potential high reliability.

"As far as payload capability is concerned, the Vanguard and Jupiter C could place in a 300-mile orbit about a 25lb payload. The Juno 2 could perform the same mission with a 100lb payload, the Thor-Able 200lb, and the Delta configuration will more than double this performance with about a 480lb capability for this particular mission. Of their successors, Scout can handle a 200lb payload for a fraction of the cost, and the Thor-Agena B will be able to put 1,250lb in a 300-mile orbit.

"The Agena B stage will also be used by NASA, as well as the Air Force, on top of the Atlas as a first stage. The Atlas booster will increase the 300-mile orbit payload capability of the Agena B to about 5,300lb.

"Later in 1961 we are scheduled to launch our first Centaur. The Centaur will be the first vehicle to employ a high-energy upper stage, and this liquid hydrogen/liquid oxygen stage is the first to employ a rocket engine developed primarily for space use. The added specific impulse afforded by hydrogen as a fuel gives the Centaur half again the payload of the Atlas-Agena B in a low orbit, and nearly three times as much payload when used as a lunar probe, which is one of its principal missions in the NASA program. In Centaur, the US has a launch vehicle able to duplicate the payload capability of the Sputnik vehicles.

"The Centaur is of major interest to the Department of Defense as well as to the NASA. In fact, the Centaur performance objectives originally stemmed from the DOD requirements for a 24-hour communications satellite. The importance of the Centaur to NASA, however, is much more far-reaching than the capability of the Centaur vehicle itself because of its relationship to Saturn. The Centaur upper stage will become the top stage for Saturn. In addition, four Centaur engines will power the second Saturn stage. In fact, liquid hydrogen begins to look as though it will dominate the launch vehicle upper-stage picture both as a fuel for chemical rockets and as a working fluid for nuclear rockets.

"The Saturn vehicle is being developed under the management of Wernher von Braun's Marshall Space Flight Center. As most of you know, the Saturn's first stage consists of a cluster of eight uprated Jupiter-Thor type engines, with a total thrust of 1,500,000lb. On top of it we will use the two hydrogen/oxygen stages I just mentioned. When we get this Saturn C-1 vehicle, which is the initial version of Saturn, our payload capability gets a king-sized boost—to 25,000lb in a 300-mile orbit.

"One, and possibly two later versions of Saturn are planned. The second model, called C-2, will add another stage using four 200,000lb thrust LO_2/LH_2 engines. The third model, if we decide to build it, will be called the C-3 and will have still another stage, using two of these 200,000lb thrust engines.

"We have had a great deal of study and analysis in progress for the past year to try to define the vehicle which will follow the Saturn. The principal mission which we have used as an objective in these planning studies has been that of landing a manned spacecraft on the Moon, then returning a 10,000lb re-entry package to the Earth. The study has followed two principal approaches. The first was what you might call the brute force attack, known as Nova.

"There have been many references to Nova, as a vehicle, in the Press and elsewhere. Nova is not a vehicle—it is simply one of a number of vehicle concepts which we have considered for the use of the 1,500,000lb thrust single-chamber F-1 engine now under development for NASA at Rocketdyne. Under this brute force approach, six of these large 1.5 million pound thrust engines would be used in the first stage. Four hydrogen/oxygen stages could be piled on top of this big booster to give us the 10,000lb lunar return package that we need.

"This concept is beginning to face increasing competition from vehicle studies with nuclear upper-stage rockets. Encouraging results from the initial Kiwi-A nuclear rocket reactor test last summer have stimulated our hopes that the large increase in efficiency which we get from using one or more nuclear upper stage, with weights less than one-third that of the Nova for the same mission capability, can be acquired by the time our program has reached the point where we need something beyond Saturn. Toward that end, the NASA and the Atomic Energy Commission are increasing the pace of the Rover program, as the nuclear rocket program is known, aiming for an orbital flight test of a prototype nuclear rocket in 1965, boosted by Saturn."

On May 18 it was announced by Nord-Aviation that the West German Army has signed a contract worth some £7,234,000 for anti-tank missiles (doubtless S.S.11s).

Wearing an Avco Mk 4 nosecone, a C-series Titan made a successful 5,000-mile flight down the Atlantic Missile Range on May 13. The data capsule was recovered by the range ship *Victor* 3hr after the firing.

A NATO missile training base is to be established on the Greek island of Crete. A survey has been approved by SHAPE and the eventual base will be available to all NATO nations for firing missiles with ranges below 150 miles. The base will be provided with satellite-tracking equipment.

A Boeing IM-99B Bomarc flew "more than 270 miles" down the Eglin Gulf Range on May 17, intercepting a simulated electronic target at an unstated altitude. This was the second successful test of the Bomarc B; the first eight launchings were failures, causing consternation to the Canadian Government who are relying heavily on this missile.

In the original lists of "releasable information" on the Atlas and Titan ICBMs, the USAF quoted the range of these missiles as 5,500 n.m. (6,333 miles). On May 1 it was announced by SAC that the current Atlas D now emplaced at Vandenburg and Warren has a range of 6,400 n.m. (7,370 miles) and that later versions, scheduled for hard emplacement, will have a range of 7,000 n.m. The latter range is already reached by the first operational version of Titan, and an advanced Titan for development in 1962 will have a range of 8,500 n.m. (9,788 miles).

One of the first Champion Tri-Travellers to arrive in England, G-APYT was assembled at Ramsgate Airport by Aviation Engineering Co earlier this month for the British distributor, Edward Drewey. Six Tri-Travellers will form the nucleus of a new flying club at Biggin Hill, and subsequent machines will be sold by Maitland Drewery Aviation Ltd at a price of £2,995.

Sport and Business

A MEMORANDUM presented by the Royal Aero Club to the Conservative Party Aviation Committee during March has been reproduced in the May issue of the Club's *Gazette*. This begins by pointing out that British general aviation (business, executive, private, instructional and sporting flying and gliding) is "in a poor way," and continues:—

"The present sad state of affairs in the UK has largely been brought about by the fact that general aviation has not only been neglected in the UK since the war, but has also been positively discouraged in Government quarters.

"There are four main factors which are throttling the growth of general aviation in this country at present. They are:—

1. *The continued reduction in the number of airfields available.*
2. *Restrictive regulations, which make "casual" flights difficult.*
3. *The lack of customs amenities for small aircraft.*
4. *The absence of any Government policy for the encouragement of light aviation in the UK—in marked contrast to other countries.*

"These four factors have discouraged a home demand which would be adequate to make profitable the production of suitable aircraft and radio equipment by UK manufacturers. Hence the fact that British flyers are now turning to American equipment."

After dealing in turn with the market, lack of suitable airfields for small aircraft, restrictions at major airports, lack of amenities and lack of suitable aircraft and equipment, the memorandum concludes:—

"British general aviation is thus being discouraged because of lack of adequate Government support—by lack of airfields, hangarage, customs facilities, by restrictive provisions at major airports, by unrealistic radio frequencies requirements and by the heaviest landing fees in the world. Furthermore, the winding-up of the Kemsley Flying Trust—one factor which has assisted British light aviation since the war—will have a further depressing effect.

"The Royal Aero Club puts forward the following recommendations to remedy this state of affairs, and to assist in the promotion of the healthy home market which will bring valuable export sales.

(i) The setting up of a General-aviation Branch in the Ministry of Aviation charged with the responsibility for encouraging and assisting light aviation and gliding. Such a Branch should contain practising pilots in senior positions.

(ii) The launching by HMG of a National Flying Trust to replace the Kemsley Flying Trust, and make available interest-free loans to suitable bodies for the development of British general aviation.

(iii) A national survey of aerodromes—Civil and Service—to be made available to general aviation—including a re-examination for the re-opening of some of those aerodromes recently closed, specifically in the London area.

(iv) Provision of customs facilities for general aviation at all State-owned airfields and a number of those owned by municipalities.

(v) Provision of hangarage available to general aviation at all State-owned airfields.

(vi) A drastic reduction in landing fees and aerodrome charges to general aviation—in line with international practice.

(vii) Exemption from fuel tax for all forms of light aircraft, other than business users.

(viii) The holding of a Government competition for the design of a range of new British light aircraft for both civil and military communications duties.

"A strong and healthy light aircraft and gliding movement in the United Kingdom is the most satisfactory method of encouraging the national air-faring outlook among our peoples, which can mean so much to this country in the Air Age ahead."

IN THE HOUSE OF COMMONS on May 16 Gp Capt R. Collard asked the Minister of Aviation if he would consider setting up a National Flying Trust for the purpose of making fixed-interest loans to suitable bodies for the encouragement and development of club and private flying. Mr Sandys replied: "A suggestion on these lines was made recently by the Standing Joint Committee on Private and Club Flying and Gliding, and I understand that it is being considered by those concerned." In a further question, Mr Collard inquired what progress had been made in preparing the specification for an economical light aircraft: the Minister replied that the specification had been approved by the standing joint committee and was now being circulated to the industry.

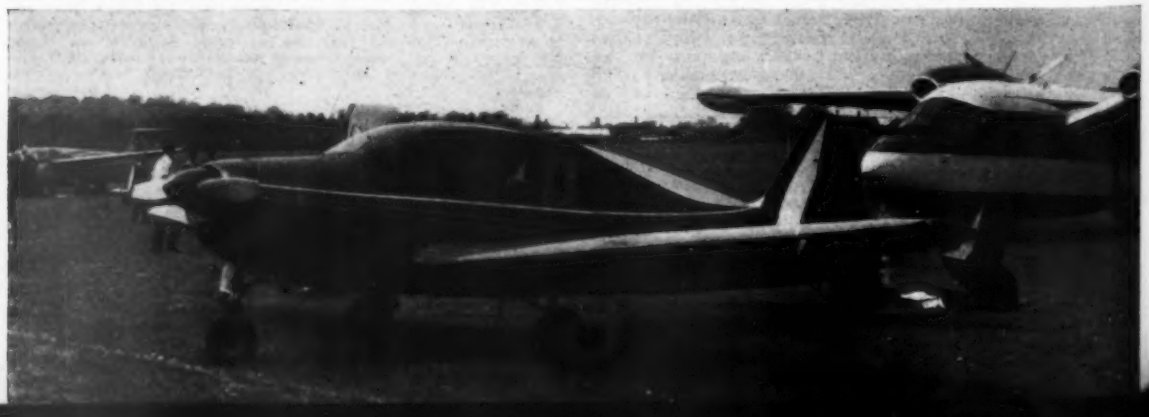
PIPER SUPER CUB and Caribbean aircraft are now available for hire to flying clubs from a newly formed company, Rent-a-Plane Ltd, at Oxford Airport, Kidlington. Clubs are required to guarantee a minimum annual utilization of 200, 300, 350 or 400 hours, and pay an hourly flat rate, which varies from £3 to £3 10s for the Super Cub and £3 17s 6d to £4 10s for the Caribbean. Hangarage and fuel are stated to be the only extra costs involved for the hiring club, with maintenance, insurance and depreciation covered by Rent-a-Plane. Directors of the company are Tom Brooke-Smith, J. N. Christopherson and R. O. Camac.

RETROSPECT

From "Flight" of May 28, 1910

Attending Police Court by Aeroplane: Although in comparison with his attempts to fly to Manchester, Mr Claude Grahame-White's exploit on Saturday last was but a minor affair, yet it clearly demonstrated the utility of the aeroplane for travelling from point to point direct. Summoned to appear at Woking Petty Sessions for exceeding the speed limit, he flew from Brooklands to Woking on his Henry Farman biplane the same as he used in the London to Manchester attempts. He came down in a meadow adjoining Westfield Common, about two miles beyond the town, having covered the six miles in eight minutes. After being fined £5 and costs for driving at a speed alleged by the police to be 40 miles an hour, Mr White was invited by one of the magistrates to tea. About half-past seven in the evening Mr Grahame-White flew back again to Brooklands, flying along the railway line between Woking and Weybridge.

This Continental-powered Bellanca 260 was on view at the recent Kidlington sales weekend. A flight report appeared in last week's issue



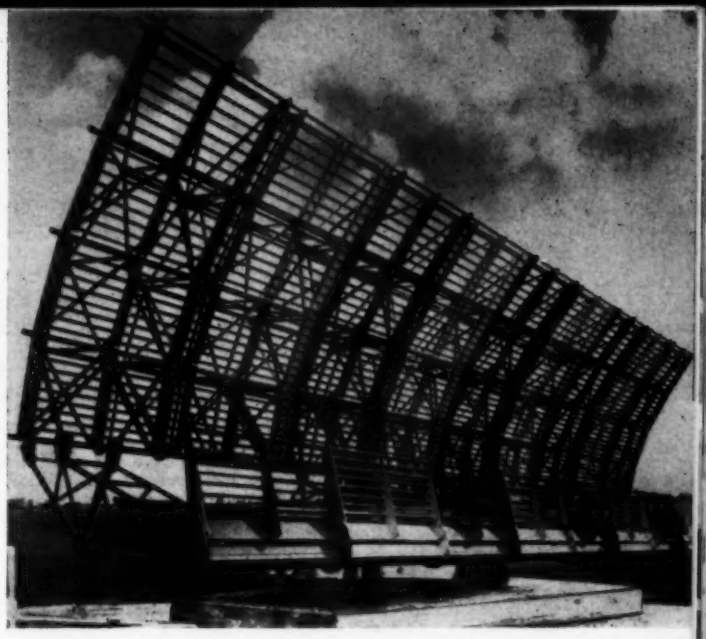
FLIGHT SYSTEM SURVEY

Marconi S 307 Surveillance Radar

LATEST in the line of Marconi 50cm surveillance radars is the type S 307, which possesses all the qualities of the long-range type S 264A but offers improved definition and greater range. The aerial, illustrated here, consists of a 67ft 6in parabolic reflector 12ft high formed by aluminium-alloy rods and energized by an offset, slotted linear waveguide. Horizontal beam-width is about 1.75°. Housed in a reinforced concrete building beneath the aerial are the type SR 100 high-performance receiver and a transmitter, modulator and power unit, all mounted in a four-bay cabinet. Aerial rotation speeds of 5 and 10 r.p.m. are provided and the 4½in spacing between reflector rods reduces the power required to turn the aerial in a high wind.

Radar signals from the aerial head are passed at an IF of 44.25Mc/s to a radar distribution unit in a control tower or centre where locally generated calibration marks and range-gated MTI are added. Either cancelled or uncancelled channels can be selected for a variety of displays of the SD 701 or SD 1000 type and the centre may be up to 4,500yd from the aerial. Greater separations may be achieved with a radar link.

Radio frequency is 585-610Mc/s and peak power output 500kW nominal. Pulse recurrence frequencies may be 260 to 385 at 4μs or 3μs, or 500 to 550 at 3μs only. Receiver noise factor is 7-8dB. Polarization is horizontal.



The 67ft 6in wide aerial of the new Marconi S 307 surveillance radar

Midas at Belfast

To record vibration levels in the Short SC.1 VTOL research aircraft during transition flights, a Royston Instruments Midas flight recorder has been fitted in the lower aft equipment bay. Some 30 pick-ups are located throughout the airframe and readings from a pre-selected group of six of them are simultaneously recorded on tape in five 10sec runs each minute. There is a 10sec blank each minute and a voice channel is included so that the pilot may also record particular flight conditions. The tapes can be analysed on Midas play-back equipment either at RAE or Royston Instruments Ltd to show a frequency amplitude plot up to 500c/s. Midas, which is being jointly marketed by Lockheed in the US, is also proposed for use as an airline flight recorder.

FAA Radio and Computers

FIVE additional megacycles in the VHF band will, from the beginning of July, be allotted to air traffic control in the US. After considerable planning and consultation with all the government bodies and operating associations involved, it has been decided that the frequencies between 126.825Mc/s and 128.825Mc/s and between 132.025Mc/s and 135.0Mc/s are to be used for ATC, thus providing an additional 100 frequencies at 50kc/s spacing. Additional stipulations have been made to cater for those aircraft whose receivers do not tune beyond 127Mc/s and those which operate only on 100kc/s spacing. On July 7, 300 frequency changes will come into effect and 300 more will follow in the subsequent three months. This is the first increase in the VHF radio spectrum for ATC communications since October 1946 and it will greatly reduce interference between neighbouring stations which have hitherto been obliged to use common frequencies.

As part of the continuing intensive investigation into the application of computers to traffic control, the FAA has placed a $5,974,500 contract with the Mitre Corp of Lexington for the design and testing of a semi-automatic air traffic en route control system using existing SAGE air defence facilities. Mitre will share the SAGE computer at Lexington and defence radars in New York, New England and New Jersey, the operation being co-ordinated with other experimental equipment for terminal control at the FAA's experimental centre at Atlantic City. The programme will take two years and will involve the co-operation of the Department of Defense and USAF.

Another phase of military/civil co-operation is Project Trailsmoke, a "civil jet advisory service program," in which FAA controllers stationed at 38 defence radar sites will provide an advisory service for civil jet aircraft. Throughout the summer months the defence centres will be used in this way to track and direct both military and civil aircraft.

The FAA has now opened a new laboratory equipped with a Remington Rand UNIVAC File-1 computer and auxiliary devices at its experimental centre at Atlantic City. Similar computers are already installed at operational control centres at Indianapolis, New York, Washington, Pittsburg, Cleveland and Boston and are being used to automate the production of flight progress strips. The computer at Atlantic City will be used for simulation of proposed new control methods both with and without actual aircraft as a preliminary to the introduction of new techniques on the airways.

Royston Instruments Midas multi-channel flight recorder being installed for vibration measurements in the Short SC.1 at Bedford

Lear Miniature Yaw Damper

THE astronics division of Lear Inc has designed and is to produce a miniaturized single-axis damping system for high-speed aircraft. The electronic package of this equipment employs "Millimin" high-density packaging and miniature circuitry which have reduced the size of the unit to that of a pack of playing cards. The new system has been fitted as a yaw damper to the Swiss P-16 strike fighter and a $6,000 contract has been placed by Fiat for units to be used as pitch dampers in the G.91. Both these aircraft were test flown by W. P. Lear Jr, the company's vice-president and director of European operations. Lear have produced the three-axis damper system for the F-104, two-axis systems for the Northrop T-38 and single-axis systems for F-86D and Grumman F9F. Some of the company's equipment is also fitted in the English Electric Lightning and the Westland Wessex.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Scotland's Air Services

THE article "The Domestic Scene" in your issue of April 8 gave the impression that all scheduled routes in Scotland are being operated purely as social services. An overall loss is no doubt being incurred, but in view of the success of the pre-nationalization companies could it be that BEA have failed to develop the type of service suited to local requirements?

The capacity being offered to the Islands may be adequate for current requirements, but little has been done to foster traffic between the inland centres of population. To route a service from Glasgow to Orkney/Shetland via Edinburgh and Aberdeen renders air travel between Glasgow and Aberdeen unattractive, while the Glasgow to Edinburgh leg must be totally unproductive. Unless a realistic attempt is made to develop the traffic potential within the entire area covered by a particular service the introduction of the Herald or Viscount will merely increase existing losses.

The geographical position of Scotland offers scope for air travel which, at present, is being catered for only on a limited scale. For example, Aberdeen Airport serves a reasonably populated area where there is a good influx of visitors during the holiday season. Allowing for this and the fact that there is an all-the-year-round flow of people to and from the south, Aberdeen is not favoured with a through service to London. This represents the longest route between reasonable centres of population in the country, with a rail journey time varying from 10 to 12 hours. Surely this presents an opportunity for one of the independent companies, particularly since a speedy passenger transport system is now essential to assist the development of the tourist trade and industrial growth of the area? BEA currently provide a limited connecting service to London, but the normal single and return fares are unattractive to the average traveller. The necessity to change aircraft *en route* is a deterrent, while the lack of a Sunday service restricts weekend or even holiday travel.

Glasgow N2 G. REID

Brazilian Diversion

I HAVE noticed in the May 13 issue of your magazine a photograph of the Handley Page Herald in Rio de Janeiro. May I suggest that, in view of the important blocks of building in the background, this photograph was taken at Santos-Dumont Airport and not at Galeão as quoted?

Galeão Airport is situated 13 miles from Rio on a very flat island and there are no buildings of any importance for miles around, the airport building being only two stories high. The airport of Santos-Dumont is right in the business centre of Rio and I remember walking from my hotel to the airport one fine morning in 15 minutes flat.

I would also mention that if one is going to demonstrate a short-haul aircraft, one would take advantage of an airport in the centre of a city instead of having to trail 13 miles (past the Rio sewage-disposal centre!) to an airport whose runway is anyway, at present, under repair.

Dublin P. C. EPPS,
Air France District Manager for Ireland

IS not the picture in fact taken on Santos-Dumont Airport? This airport was constructed, adjoining the city, before Hitler's war with runways of a thousand metres which the Brazilians justifiably thought would be good enough; for, they must have thought, airliners will need less run as time goes on. But during the war longer and longer runways were laid down all over the world for strategic purposes; and airliner designers took advantage of this to get higher speed with correspondingly higher landing speed.

And when the war ended Santos-Dumont was too small and a new airport was built to international standards on an island in the harbour quite a way from the city. Obviously the Herald would have wanted to show its capabilities at the restricted Santos-Dumont in the city precincts rather than at remote Galeão.

London W14 GEOFFREY DORMAN

[We stand corrected, and thank these and other correspondents who have written to similar effect.—Ed.]

More Airline Accidents

I NOTICE that in *Flight* for April 26 two airliner crashes were reported as "the eleventh and twelfth this year." However, in addition to the major wrecks you have reported, an examination of *Lloyd's List* shows that four more accidents had occurred within the period to transport aircraft, on various local flights, involving loss of passenger lives. These were: 16.3.'60, Nippon Airways DC-3 (collision with jet on landing), five passengers killed; 20.3.'60, Colombian Aida Canso, four killed; 5.4.'60, Nicaraguan Lanica C-46, three killed; 12.4.'60, Brazilian Varig DC-3 (burst tyre on landing), five killed.

Wallington, Surrey. P. S. CHAMBERLAIN

FORTHCOMING EVENTS

May	28.	Northern School of Aviation Flying Club; At Home and Flying Meeting, Squires Gate, Blackpool.
May	28-June 6.	National Gliding Week.
May	28-29.	Skegness Aero Club: International Rally.
May	29.	Doubs Aero Club: Touring Aircraft Rally, Besançon.
June	1.	London Society of Air-Britain: "Under the Arches," by Maj C. Draper.
June	3-4.	RAeC: London-Cardiff Air Races, Rhoose Airport.
June	4-12.	Royal Air Force Gliding and Soaring Association: Gliding Week.
June	4-19.	German Aero Club: World Gliding Championships, Butzweiler.
June	5.	Champagne Aero Club: International Rally, Rheims.
June	5-6.	Leinster Aero Club Rally.
June	5-6.	Fréjus - St Raphael Aero Club: International Provençal Wine Rally.
June	5-6.	Vichy Aero Club: International European Aviation Meeting.
June	5-6.	Alsace Aero Club: European Light Aircraft Meeting, Strasbourg.

US DESIGNER'S HALFORD LECTURE

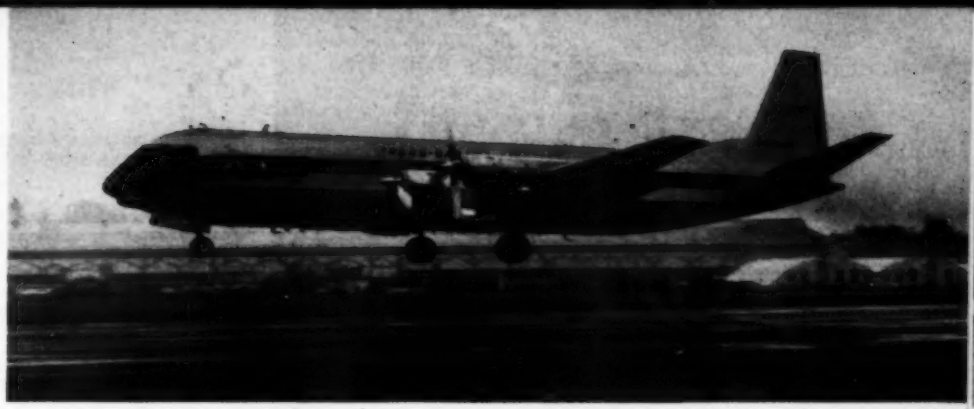
ON May 11, J. S. Alford, BS, AFRAeS, design engineer in the Aircraft Gas Turbine Division of the General Electric Company of America, read the Second Halford Lecture before a large and enthusiastic audience at the Hatfield Branch of the Royal Aeronautical Society. This was the first official function for the Society's new president, Dr E. S. Moult. The paper, which had the title of *Powerplants for Supersonic Transports*, discussed the author's personal experience in the engineering of the J79 turbojet family, installation co-ordination on the Convair B-58 Hustler, the aft-fan engine, the J93 for M3 propulsion, and future prospects. Although the general concensus of opinion after the meeting was that the author had sometimes tended to stray from his subject, the paper was exceptionally interesting and was very well received.

In his remarks concerning the J93 turbojet, Mr Alford said that the engine had been designed for flight at M3 and utilized new high-temperature alloys and honeycomb structures. It gave M3 cruise aircraft long range at altitudes over 70,000ft. An interesting innovation in the J93 was the "compartmentalization" of the controls and accessories in a removable pod, giving protection to the controls from the high inlet temperatures at M3.

On the subject of future prospects for supersonic transport propulsion, Mr Alford commented that with J93 development well under way, use of the gas generator in derivative versions was currently being studied. An aft-fan configuration with combustion in the fan stream had characteristics desirable for supersonic transports (here the lecturer showed a diagram of such a system). After combustion in the fan stream was substantially complete the two streams were discharged through a single converging-diverging jet nozzle. The gas generator was operated at lower turbine inlet temperature than in the military version in order to achieve the longer life required for transport operation. There was no particular requirement for high turbine inlet temperature at M3 unless the engine had a relatively high pressure ratio. For example, a ramjet had about the same s.f.c. if the combustion temperature matched turbojet exhaust-gas temperature. Combustion in the fan stream produced the same exhaust-gas temperature as the high-pressure-ratio, high-inlet-temperature jet engine would have.

The aft-fan with heating of the fan stream had a relatively low noise-level. For a given take-off thrust, minimum exhaust noise would be obtained by having the exit velocity of the main gas generator and the by-pass substantially the same—in other words, the by-pass flow ratio was arranged to meet the exhaust noise requirements for sea-level operation. There seemed to be no compelling reason for providing reheat in the main primary stream, except possibly to provide a torch igniter to initiate combustion in the fan stream. Simplification of the mechanical problems was obtained by limiting the burning to the aft-fan stream.

In the discussion that followed Mr Alford's paper H. Pearson of Rolls-Royce and Dr Hooker of Bristol Siddeley indulged in verbal combat for and against cooled turbine blades and low and high by-pass ratios, and over the question of whether a ducted-fan engine was not a by-pass engine with a high by-pass ratio, or a by-pass engine a ducted-fan engine with a low ducted-fan ratio.



Maiden flight of the first of TCA's 23 Vanguard 952s was made from Weybridge on May 21 by Jock Bryce. Owing to poor weather he was airborne for only 10min. This is the eighth Vanguard to fly—see "Productive Floorspace" below

AIR COMMERCE

PRODUCTIVE FLOORSPACE

THE first of 20 Vanguards ordered by TCA in January 1957 made its first flight on May 21 (see picture). Original announced delivery date was August; this may possibly be bettered.

It was possible for a *Flight* visitor to the Vanguard assembly hall at Weybridge last week to count, from one spot on the shop floor, eleven TCA Vanguards—the third to the thirteenth V.952s. The first and second aircraft have been moved to the new flight hangar.

All six of BEA's initial batch of early V.951s have been flown; they are now being brought up to final delivery standard at the manufacturer's flight test base at Wisley. The first aircraft is due to be formally handed over to BEA on June 15, for operation on July 1; the five others will be in BEA's hands by August. Meanwhile, a pre-delivery aircraft, G-APED, is to be handed over to help the crew-training programme.

To date nearly 1,400hr of test flying and route proving have been put in by eight Vanguards, and ARB certification is expected before delivery to BEA on June 15. The remaining 14 of BEA's order for 20 Vanguards, which will be of the up-weighted type (like all TCA's), will follow completion of the Canadian airline's 20 aircraft. TCA's repeat-order for three will then be dealt with.

Evidence of VC10 production now abounds: the first integrally milled wing skin panels, 34ft in length compared with the 27ft of the Vanguard, are nearly finished; some fuselage jigs have been loaded with frames and stringers, and some of the VC10's remarkable window cutout panels (which are probably unique in being one-piece machined components rather than the traditional fabricated reinforced cutouts) can be seen in place. The vast wing jigs, which vie with the Britannic's fuselage jigs at Belfast as the biggest ever installed in a British aircraft factory, and which give almost a shipyard atmosphere to one part of the Weybridge factory, are now completed and receiving the first wing components. Meanwhile work goes on with test installations in the mock-up—in the flight deck, in the cabin and fuselage, and in the wing.

Viscount production continues, the order book now being 423, and the presence of 810s on the line at Weybridge (three for All-Nippon, a fourth of six for Austrian Airlines, and three for Ghana) is tangible evidence of the fact that Vickers now, under the same roof, have three major types of airliner in production. It is probable that the Vickers assembly hall concerned, when now-completed Valiant production is taken into account, has produced more £s-worth of engineering per foot than any other in the country.

THE BILL IN THE LORDS

HAVING had its second reading in the Lords (see *Flight* last week) the Civil Aviation Licensing Bill has now passed through the committee stage of the upper chamber. Two small amendments went through: the Air Transport Licensing Board will not be responsible just for "furthering the development of British aviation"; it will only be responsible for doing this in the course of "exercising its functions under the Act." This is an acknowledgement of Lord Ogmore's point during the second reading that it is really the Ministry's job to further British aviation. (A point that seems to have been overlooked so far in this wearisome quibble is that "British aviation" includes military, as well as civil, aviation; as the Bill now stands, the new Board will be theoretically responsible for furthering the development of the RAF, the Fleet Air Arm, Association of Spotters' Clubs, etc.)

Sitting in his place in the House was Lord Douglas, chairman of BEA. He must have listened with satisfaction to Lord Shackleton's proposal that the Board should not grant air service licences if the proposed services were likely to result in material diversion. This point, already proposed in the Commons by the Labour side and rejected by the Minister, is one that has been made by Lord Douglas himself (*Flight*, "Straight and Level," March 25, page 420). Indeed, Lord Shackleton's arguments were so in line with BEA's policy here that it was almost as if he had been speaking from a BEA brief.

The Lords debated at some length whether the hovercraft is an aircraft, and therefore subject to the provisions of the Bill. This was a curious expenditure of time, because all had no doubt read the report of the fourth sitting of the House of Commons committee in which this matter was discussed, and in which the Minister made his historic remark: "The hovercraft is a little like a duck-billed platypus, which is both bird and mammal. I do not suggest that the hovercraft suckles its young, but . . . I have no doubt at all that it is an aircraft."

Another amendment acceptable to the Government clarifies an obscurity in the wording of Clause 3 (4).

CARAVELLE COLLISION

ON May 19, on a flight between Algiers and Paris and while approaching to land at Orly Airport, an Air Algerie Caravelle F-OBNI was involved in a collision with a Stampe biplane. The light aircraft ripped open the top of the Caravelle's fuselage for 15ft and the engine penetrated the cabin, injuring 19 of the 31 passengers. One passenger subsequently died but none of the crew was hurt. One engine of the Caravelle stopped and the rudder was damaged, but from 6,000ft the pilot, Cdr Moussov, managed to make a successful landing on the Orly runway.

The Stampe had taken off from Chelles-le-Pin to escort another Stampe to the flying school at St Cyr. The pilot was killed in the collision and the wreckage fell at Pontault-Combault, seven miles south of Orly. No other information is yet available, but the visibility at the time of the collision was said to be perfect.

BEA'S NEW ENGINEERING BASE

THE big extension to BEA's engineering base at London Airport, on which work started 3½ years ago, has been completed three months ahead of schedule. The hangar block, and another completed in 1953, were handed over to Lord Douglas, BEA's chairman, by Lord Ashcombe, chairman of Holland & Hannen and Cubitts, on May 19.

Prefabrication and precast concrete techniques were used in the construction of the hangar blocks which, with the completion of an office block later this year, will cover 65 acres. Hangar bays in each block are 50ft high and each has a floor area of 23,000 sq ft.

This is one of the hangars of BEA's £7m engineering base, handed over to Lord Douglas on May 19. (See note in col. 2 above)

Positively no deception; Allegheny's Napier Eland-powered Convair 540 climbs really steeply away from the Philadelphia terminal
"Flight" photograph

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TIME SAVERS

HERE is a "Flight" staff member's first-hand account of the Napier Eland in airline service, with special reference to another Allegheny-sponsored time-saving offer—a refreshingly simple ticketing system

THERE were two reasons for the visit we made earlier this month to Philadelphia. We wanted to see in action two much talked about air transport innovations—both unique, both sponsored by a progressive local service airline called Allegheny, and each in its way of interest to the UK air transport industry.

One of these innovations is the Convair 540.* Its powerplant —the Napier Eland—is the second type of British turboprop to enter US domestic service. Allegheny pioneered its entry into commercial operation on July 1 last year.

The other novelty, again unique and likewise pioneered by Allegheny, is a no-reservation ticketing system whereby passengers turn up at the airport and board aircraft with hardly more fuss than if they were Green Line coaches. This analogy can, incidentally, be taken further. Allegheny's Convair 540 N44OEL *The Penn Commuter* (picture below) has an aesthetically rather pleasing colour scheme of dark green cheat line and pale green top.

We watched the 1121hr service arrive from Pittsburgh, counted 40 passengers disembarking (91 per cent load factor), and then went up for a half-hour flight. The photograph above bears witness to the remarkable take-off. To unstick it took 12sec from the application of full power and 20sec from the start of roll at idling power. Over the end of Philadelphia's 10,000ft runway we were at 4,000ft, so Captain Willis Petrie, Allegheny's chief pilot, later told us. This was in a 17kt 90° crosswind. Admittedly we were lightly loaded.

Up front a few minutes later we watched Captain Petrie feather the port D.H. propeller, remarking: "This is the only aircraft I have flown which has as good a rate of climb on one as on two." The best climb speed on one appeared to be 130kt; the a.s.i. was indicating 160kt about half a minute after unfeathering. There was virtually no perceptible swing either on feathering or on unfeathering.

He said that normal cruising speed on the Pittsburgh-Philadelphia run was 230kt i.a.s. at 15,000ft. He was unreservedly enthusiastic about the aircraft and its engines. Yes, he thought that Napier service and support were satisfactory. Allegheny had developed their own operational techniques. He thought that Napier had a "good product," though he added that the engine deserved stronger presentation in the US market—"they could sell a lot more," he said. We landed with one feathered. An incidental impression of the flight was that the Allegheny co-pilot, Captain William Riggle, had scarcely once failed to watch out for other traffic.

Back in the terminal we had a look at Allegheny's no-reservation ticketing system. It is virtually a walk-on service, of the type that BEA plan to introduce within two years' time on UK internal services. The customer arrives at the airport, picks up a card off the ticket counter, and clocks in (see picture). Having thus stamped the time on the ticket all he has to do is to write his name on it. He then walks to the gate near the aircraft and hands his card to the Allegheny clerk. This official knows how many old-fashioned reservations have been booked and therefore how many seats are available for "commuters," and he lets card-holders on board on a first-come-first-served basis as established by the time stamped on the cards. Passengers prefer (and are allowed) to sit in the comfort of the aircraft rather than hang about in the terminal before departure.

Allegheny reckon that, on average, only 3 or 4 per cent of commuters are unable to get seats and have to wait for the next flight. The number is obviously rather greater at peak times. On board the aircraft the stewardess (Allegheny always insist on the word "hostess") collects the commuter's fare, which is $13 (including US tax) compared with the normal fare of $20.30—a 36 per cent discount. A lot of ticketing black magic is thus eliminated: (1) making the reservation; (2) purchase of a ticket from the airline or an agent; (3) confirmation of the reservation; (4) reporting to the ticket counter at the airport; and (5) checking baggage. All this means greater convenience for the passenger and, obviously, lower costs for Allegheny. And it means fewer no-shows and consequently higher load factors because it reduces the number of multiple make-sure reservations made by passengers who intend only to take up one.

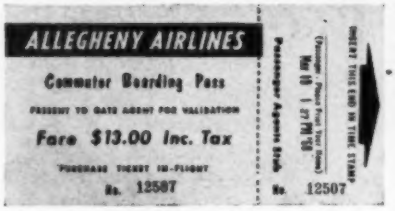
About 40 per cent of the passengers flying Allegheny between Pittsburgh and Philadelphia now take advantage of the "commuter" ticket facility—about 1,320 passengers last month. Since the scheme was introduced last October the percentage of commuter tickets sold has gone steadily up; total number of people to have taken advantage of it is now perhaps 10,000.

The prerequisite of this kind of ticketing scheme is, of course, good frequency. Allegheny and its chief competitor on this route

**Convair 540 is a converted 440, Canadair 540 is a new production aircraft manufactured by the Canadian firm in Montreal.*

The last stragglers of a 91 per cent load from Pittsburgh disembark at Philadelphia. In the background one of Allegheny's Martin 2-0-2s taxies out. Perhaps half of the Convair 540's passengers made no reservations and bought their tickets — cut-price — while in the air

"Flight" photograph



The passenger arrives at the airport, having made no reservation, picks up a boarding pass from the ticket counter, and clocks in as shown in the right-hand picture

"Flight" photograph

TWA, offer 14 round trips daily between 0800hr and 2100hr. Of these, six are operated by Allegheny, three being by the turboprop Convair 540, the others by piston Convair 440. TWA operate Super Constellations, which average 10min slower than the 540's 66-75min schedule. TWA has responded to Allegheny's fare competition by also offering a $13 fare, though it is not a no-reservation ticket in the same sense as Allegheny's. If an Allegheny commuter finds that there is no space on the Allegheny flight for which he has turned up, he buys a TWA ticket in the normal way —unless the next convenient service happens to be by Allegheny. A joint timetable is published for the convenience of the public, though there is the keenest competition between the two airlines.

Allegheny are now increasing Convair 540 seating capacity from 44 to 52, by dispensing with the forward cargo space but retaining the essential carry-on luggage racks. And they are, they say, planning "to crank more frequency into the Pittsburgh - Philadelphia market."

At the moment Allegheny have only one Convair 540. It is being operated exclusively on the Pittsburgh - Philadelphia run at a utilization averaging 7½hr daily, with a regularity claimed to be "very high." The aircraft concerned, N440EL, was actually Napier's second aircraft (PacAero-converted) which has been purchased from Napier having first of all been tried out on a lease basis.

Allegheny has ordered four more Convair 540 conversions, and has bought 12 more Elands from Napier, allowing for 50 per cent spares. In addition it has options on 45 further Elands, sufficient for converson of 15 more Convairs with 50 per cent spares. Fourteen Convair 340/440s have been bought from Lockheed (ex-National aircraft that were traded in for Electras); seven of these are in service and four others are in various stages of conversion to 540 standard. One is having its interior improved and fitted with 52 seats by Butler Aviation of Washington, and two (with interiors already done by Butler) are at AiResearch in Los Angeles undergoing the Eland conversion. Mid-June is the contract date for delivery of Allegheny's second Convair 540, and the other three will follow at intervals of five to six weeks.

It is not yet clear how soon Allegheny will take up their options on the conversion of 15 more aircraft, but we found that satisfaction with the Eland engine was unanimous. The reliability record, we were told, has been very high—though no up-to-date detailed figures were available—and passenger appeal has been marked. Passengers are said to discriminate between the piston-powered and the jet-prop Convairs on the route; they are, we were told, quite choosy in favour of the jet-prop, which is all that the ads. claim—smoothest and fastest aircraft on the route. As regards economics, the president of Allegheny, Leslie Barnes, says that he expects eventually to get the Pittsburgh - Philadelphia total cost per mile of the 540 down to 70d per mile, i.e., 1.35d per seat-mile, which would be "one of the lowest operating costs ever experienced in any airplane in commercial air transportation."

Oddly enough, Allegheny were not a Convair operator when, "after looking at everything else available," they chose the Eland-powered 540. Cautiously—because this aircraft was an unknown quantity—they leased a 540 from Napier, and later a second, for a trial. After seven months they bought one of the two, ordered four more, introduced a mass-market ticketing system to exploit the aircraft more fully, and placed options on engines to convert 15 more. So in one US airline's eyes the Eland Convair 540, notwithstanding the challenge of an indigenous competitor (the Allison 501 Convair conversion), appears to be measuring up to the commercial claims made for it. J. M. R.

TCA FEELS THE PINCH

A FEW years ago ICAO courted unpopularity by predicting that jet capacity would increase faster than traffic, thus leading to a fall in load-factors. This would be coupled with a crippling load of long-term debt. Both problems could be solved, but the industry's financial condition would suffer in the process.

Little did these economists know that the first confirmation of these views would come from only a few floors down in Montreal's International Aviation Building. Yet the latest annual report for TCA provides the clearest indication of what the 'sixties are likely to offer. In the normal course of events 1959 would have been a bumper year for this carrier; reduced fuel prices and extended Dart overhaul life cut unit costs to 37 cents (32 pence) per c.t.m.; traffic grew by 12 per cent, the annual volume of passenger traffic exceeded the three million mark for the first time; and revenue rates were more or less unchanged, the spread of conomy fares on the Atlantic being offset by higher fares in North America. Yet TCA came very close to showing a loss.

The explanation lies partly in the sudden fall in load-factor from 60 to 58 per cent. (The deceptively small gap between these two figures meant a reduction in TCA's revenue of some $2½m.) The other factor, as forecast by ICAO, was the rise in long-term indebtedness, in the case of TCA last year from $83m to $135m. The bulk of this was not tied up in productive assets but in progress payments to Douglas and Vickers. This involved a rise in interest payments from $2½m to $3m.

Despite these disappointing figures for 1959, TCA have perhaps less cause for concern when viewing the sixties than many of their international rivals. On the one hand, their choice of new equipment will place them in an unusually favourable position to cut costs over a period when others who have been less discriminating will be struggling to make ends meet. Their Conway-powered DC-8s look like being the most economically efficient of the first-generation big jets, while the Vanguards offer unique scope for fare reduction (although a seat capacity of 96 seats hardly seems the best way of exploiting this aircraft's capabilities).

The other factor which favours TCA is the potential development of the Caribbean. Not only by creating new business, but also by evening out the peak-trough problem, this expansion southwards towards the sun is likely to prove of considerable long-term economic significance. The possibility of a tie-up with BWIA would fit logically into this pattern.

Features of the report that call for comment are frequent oblique references to Canadian Pacific. This newly licensed transcontinental carrier is blamed in part for TCA's fall in load factor. Yet TCA chose to schedule an additional daily service, bringing their peak daily transcontinental frequency from 11 to 12 in each direction (equivalent to a rise from 650 to 700 seats daily). A later paragraph reminds the reader about the existence of those old friends of all nationalized airlines throughout the world: "the points that would not normally be served by an enterprise concerned solely with profit potential." A further dig, aimed at CPA's much-advertised Britannias, emphasizes that TCA's DC-8s and Vanguards will be "larger and faster than any commercial aircraft yet used by a Canadian airline."

QUESTIONS AND ANSWERS

THE pilot of the Transair DC-3 which last August crashed into a mountain soon after taking off from Barcelona "successfully completed the tests required in respect of a non-scheduled flight from London to Barcelona." This was the essential point made by the Parliamentary Secretary to the Ministry of Aviation, Geoffrey Rippon, when subjected to keen questioning in the House of Commons on May 16 by John Howard (Con, Southampton, Test) and Dr Horace King (Lab, Southampton, Itchen).

The two Members were speaking on behalf of relatives of those who lost their lives (the crew of three and 29 passengers, members of the National Union of Students, were all killed). They were concerned with aspects of the accident not dealt with in the "extremely brief" and "shockingly inadequate" Spanish report. Among the questions they asked were:—

(1) Why was the report published without Ministry comment?
(2) Are the regulations, particularly as regards the briefing of pilots on the hazards of this route, being carried out?
(3) Are the regulations covering non-scheduled flights adequate?
(4) How did the Ministry satisfy themselves that the pilot had passed the tests required by the regulations as to his knowledge of the route?
(5) Was the flight schedule [flight plan] inspected?
(6) What evidence [none was published] was taken?

Mr Rippon gave no answer to question (1), though he remarked

A special flight on the London - Amsterdam route on May 17 by a KLM DC-8 was the occasion for a christening ceremony by Sir Frank Whittle, who gave his own name to the aircraft, the third of 12 which the airline are naming after aviation scientists and pioneers. A guest in the cockpit was Capt H. (Jerry) Shaw (left-hand seat), pilot of the D.H.9 which inaugurated the same service 40 years ago

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that the Ministry's accidents investigation branch "finds no reason to disagree with the main findings of the Spanish board" and that there is "no reason at all to believe that any further investigation would throw any more light on the circumstances."

To questions (2) and (3) Mr Rippon replied that the pilot and the crew were all properly qualified and experienced. In the case of a non-scheduled journey the law required that the pilot should, within twelve months, have been tested as to his knowledge of the terrain and all other operational aspects of the route. It was also required that within six months he should have been tested as to his proficiency in using the relevant instrument approach system.

Here Mr Howard interpolated: "Will not my hon Friend agree that it is rather surprising that, according to what has been said, the first time this pilot flew on this route was as a captain of the aircraft? Whatever the regulations may say, surely that is a thing to be avoided." Mr Rippon's reply was that while pilots are required to be under supervision on a scheduled service if they have had no previous experience of a route, this did not apply in the case of charter flights. The difference was that charter flights "can be postponed more easily if a pilot for any reasons feels unhappy."

To questions (4), (5) and (6) Mr Rippon did not reply.

EASTERN AND THE BOEING 727

THE possibility of a joint Boeing-de Havilland D.H.121 programme (*Flight*, April 1, page 457) appears to recede rather than to advance in the light of present 727 sales activities. Now at Seattle, it is reported, is a team from Eastern Air Lines, and American sources report that talks between the airline and the manufacturer "have progressed close to the final negotiation stage with chances considered good for an order of up to 40 Boeing 727s." Eastern's president, Eddie Rickenbacker, says that the 727 appears to have "good economic and operational potential." The 727 would, he says, supersede the Electra.

United and American are also said to be showing interest—"strong interest" in the case of United. It will be recalled that, when United placed its Caravelle order four months ago, Mr Patterson said that his airline might follow up with an order for about 40 aircraft "of the Boeing 727 type" for delivery in 1964.

No specification for the 727 has been published by Boeing, but it continues to resemble the 121, being based on a triple rear-engined powerplant of Allison-built Rolls-Royce ARB.963s (*Flight*, January 29, page 162).

—AND THE CONVAIR MODEL 60

DESPITE recent comings and goings between Hatfield and San Diego (*Flight*, April 1), Convair are said to be trying out short-haul jet projects on the US airlines. One is designated Convair Model 60, a twin-engined aeroplane weighing 140,000lb or 145,000lb powered by either P & W JT3D-5 or GE CJ805-41C turbofans. It is reported that it could be available by 1962, before both the D.H.121 and the Boeing 727.

MRS MUNRO'S MARATHON

A SECOND adjournment of the Anglo-American talks on the Bermuda agreement is announced. Inability to reach agreement has certainly not come about for lack of trying: the first round of the negotiations, at Barbados, lasted from February 24 to March 17; the second and latest round, in Washington, lasted from April 28 to May 18. Altogether therefore Mrs Alison Munro and her Ministry team (with BOAC and BWIA representatives rarely far away) have been bargaining with the US team—comprising State Department and CAB representatives led by Laurence Vass—on and off for five solid weeks, including an allowance for time off for breathers.

At least neither side can now be in any doubt about the other's route requirements; and the official statement that talks are to be resumed later in London suggests that, despite the obvious strains of this negotiating marathon, neither side has impatiently slammed the door. The issues at stake have been reviewed in *Flight* as follows: February 26, page 293; March 25, page 424; April 1, page 456; May 20, page 697.

SWISSAIR'S 92DB CARAVELLES

SWISSAIR'S inaugural jet service was flown from London to Zurich on Saturday, May 21, by Caravelle HB-ICW, the third Caravelle to be delivered to the airline. A full load of 20 first-class and 50 tourist passengers was carried and the total time for the flight was 1hr 19min. To mark the inaugural an elaborate meal was offered to all passengers with only 61min for serving time; service was completed before arrival at Zurich.

On Friday, May 20, the Swiss authorities carried out noise-decibel tests with Swiss instruments at Zurich Airport. Their findings credit a DC-7C with 107db, a Super Constellation with 113db, a DC-6B with 103db, a Caravelle with 98db and a Caravelle with sound suppressors (all of Swissair's Caravelles are so equipped) with 92db. On a similar basis the Comet 4B is credited with 95db; no Boeing 707 or DC-8 has yet been tested. The test conditions are presumed to be comparable, though no data are available. Decibels are of course an inadequate measure of *noisiness*, recording sound pressure only.

ACADEMIC JUDGMENT

ONE of the prickliest thorns in the side of the Ministry and the corporations has been the operation by travel agents, in conjunction with independents, of allegedly bogus closed-group services. By the simple device of suggesting to customers that they join a convenient club, tour operators have "packaged up" thousands of ordinary members of the public and despatched them on cheap holidays without, they have hoped, contravening Section 24 of the 1949 Air Corporations Act.

In April 1959 the Ministry decided to test the legality of such alleged evasions by prosecuting Milbanke Tours, who in association with Hunting-Clan had offered inclusive-tour holidays to members of the public who joined the International English Language Association. A Feltham magistrate's court dismissed the case, and their judgment was upheld last week in the Divisional Court. IELA was held by the court to be a *bona fide* organization.

Had the Ministry chosen to test the *bona fide* nature of some of the other "clubs" and "associations" that have sprung up, possibly the outcome would have been different. Some agents have been asking the public to join flagrantly bogus clubs in order to obtain customers, and the law has been made to look, in many cases, an ass.

But the Divisional Court's ruling is academic. One of the provisions of the new Civil Aviation (Licensing) Bill, which is expected to become law next month, is that all closed-group operations will be required to have a licence. The "bogus club" loophole will be closed.

A note on the transitional licences which will be required the moment the Bill becomes law appeared in last week's issue.

THE NEW PATTERN TAKES SHAPE

NOW being advertised by Eagle Airways, the new air arm of Cunard, are the mid-Atlantic services which are to be operated as from October 1. It was always certain that the coach class cabotage service to Bermuda would be operated by Eagle; it was only "possible" that Eagle would also be able to extend this service to Nassau (*Flight*, April 29, page 609). This is now confirmed. Eagle will probably use DC-6Cs in all-coach configuration, though the possible acquisition of a DC-7C from BOAC has been reported. Frequency will be monthly, and the service will be in pool with BOAC. It is understood that Eagle and BOAC will operate this service alternate months.

Under the new deal Eagle—unlike British United Airways on the African routes—will also share first-class business with BOAC. Eagle will operate first-class and economy-class to Bermuda and to Nassau at a weekly frequency. These operations, which may be with mixed-class Britannias, will also be in pool with BOAC, and they will be quite separate from the above-mentioned low-frequency, low-fare coach flights.

TWA MAY MERGE WITH NORTHEAST

THE board of Northeast Airlines (president, James W. Austin) has proposed that the airline should merge with TWA. The basis of this agreement would be an exchange of shares between Northeast and TWA on a three-for-one basis, and it is confirmed by TWA's president, Charles S. Thomas, that his airline is interested and that it has the merger "under consideration."

Before such a link-up could take place, approval would have to be given by the CAB, the US Securities and Exchange Commission, and senior creditors and shareholders of Northeast and TWA. An equipment arrangement was arrived at last year whereby Northeast leased from TWA a Boeing 707-131 and a 707-321 for its route between New York and Florida. This was a device to counter jet competition from National and Eastern, both of whom may be expected to object to the powerful competition that a TWA-Northeast merger could produce on this much-contested East Coast route.

Northeast are essentially an old-established New England regional carrier with headquarters at Boston and roots going back to 1933 when the airline was formed as Boston-Maine Airways. Though they have experienced growth rates above-average for the US airline industry in the past three years (April 1960 revenue passenger miles were up 19.5 per cent of those in April 1959), this expansion has not been marked by any great financial success. In spite of a 30 per cent increase in passenger revenues for 1959, loss on the year's operations was $7m.

News of the merger proposals coincided with an announcement that Northeast has concluded an arrangement with General Dynamics and General Electric for the lease of six Convair 880s, part of an order for 30 placed originally by the Hughes Tool Co. The last-named company is owned by Howard Hughes, who is also a shareholder (with no voting rights) in the Atlas Corporation, which has a majority shareholding in Northeast. Hughes Tool are to lend up to $9.5m to Northeast for "jet integration expenses and other working capital," and the six CV-880s should be on the Florida route next winter.

Footnote: Northeast's present fleet comprises eleven DC-3s, ten DC-6Bs and ten Viscount 745s. The airline say that there has been "a strong public acceptance of the Viscount" and quote a 55 per cent increase in Viscount traffic on the New York - Boston route in the first quarter of the year. Viscount system load factor was 68.5 per cent.

HOME BY SEA

BARELY a month since Channel Air Bridge inaugurated rail/air no-passport day trips to Calais the company announces other no-passport trips out by air and back by sea. The sea carrier concerned is Eagle Steamers, and Home Office and French Government approval has been given for these joint no-passport services between Southend and Calais. No starting date has yet been announced but it will be this year and the fare will be £3 12s return. This compares with the day trip sea return fare of £2 and the air return fare of £3 19s. There is an additional charge of 1s 6d on the bus service into Calais town centre, or 7s 6d return to Dunkirk.

Specific flights from Southend are to be allocated to this service and these leave at 0810, 0950 and 1130hr. The Eagle steamer *Royal Daffodil* will leave Calais at 1700hr.

BREVITIES

The Air Registration Board have issued BCAR Section E, Issue 2, *Gliders* and contents list Issue 30, May 16.

A C-46 of Navegacao Aerea Brasileira SA Nova Organizacas crashed near the runway at Ramey air force base Puerto Rico on May 9. All five occupants were killed.

Manchester Corporation are to spend £700,000 on a new terminal apron and other improvements to Ringway Airport. The contractor will be Richard Costain.

Norronafly of Norway has bought two Elizabethans from BEA for use on charters and inclusive tours. They will replace the airline's Convair 240, now sold.

United Kingdom airlines' traffic in March was 18 per cent greater than last year; although capacity was up by 20 per cent, load factor fell a point from 61 to 60 per cent.

Alitalia started jet services last Monday with a Caravelle service between London and Rome. Frequency is daily and scheduled journey time is 2hr 20min.

A Federal grand jury in Los Angeles has found that TWA was partly at fault in the airliner collision over the Grand Canyon, Arizona, on June 30, 1956, in which 128 people were killed. The jury awarded about £105,000 to survivors of the pilot and navigator of the United Air Lines DC-7. United were cleared of blame.

Sabena lost £1.4m on its operations in 1959 due, it says, to: rioting in Leopoldville last January; ebb of traffic after the Brussels Fair; competition from other airlines' jets on the North Atlantic; and the slow revival of the Belgian economy following the 1958 recession. Deficit is to be covered by a government loan to be paid back from future profits.

Joseph Roos has been appointed chairman of the board of the Institut du Transport Aérien. He succeeds the late Henri Siegfried.

The Guild of Air Pilots and Air Navigators will present the annual Meteorological Office awards on June 28 at 14 South Street, Park Lane, London W1, at 1600hr.

A Balair DC-4 crashed at Djebel Marr, 470 miles south of Khartoum on May 15. All 12 passengers and crew on board lost their lives. It was on a flight from Dahomey to Niamey.

The quadripartite pool of BOAC, South African Airways, Central African Airways and East African Airways should become effective in October. This arrangement will supersede the present arrangement of separate pool agreements.

A Delta Air Lines Convair 880 crashed and caught fire after taking off from Atlanta Airport, Georgia, on May 23. It was on a training flight and was carrying a crew of four. Delta officials are reported as saying that a power failure occurred.

Announced last week was the SIPA 270 Presence, a new French transport with an all-up weight of about 10,000lb and capable of carrying a car or up to 16 passengers. It is a twin-boom design powered by two Turboméca Astazous. Design work is well advanced.

Provisional Government approval has been given to Inter-City Airways to operate helicopter services to the Isle of Wight. Westland Widgeons will be used and provisional authorization covers 20 return flights daily between Portsmouth and Ryde, 20 between Southampton and Cowes and four on the route Portsmouth, Ryde, Shanklin, Newport, Cowes and Southampton. The application is effective for ten years from this month.

Used at Prestwick on the first occasion that BOAC's 707-420 visited the airport was a Blackburn starter truck. This was the first time the equipment had been used for starting a Conway. It is being employed with other 707s at London Airport and Paris

A new recruit to the Herald sales team is G. M. Shipway, who has joined Handley Page (Reading) Ltd as commercial sales representative. He was previously with Rolls-Royce

SERVICE AVIATION

Air Force, Naval and Army Flying News

South American Tour

THE Secretary of State for Air is at present visiting five South American capitals, and was due to participate in the 150th anniversary celebrations of Argentine independence in Buenos Aires this week. With Mr Ward, who is flying in a Transport Command Comet, is an RAF detachment consisting of two Bomber Command Vulcans and a Transport Command Britannia.

When the goodwill tour ends—on June 4—the aircraft will have given demonstrations in eight capitals and will have flown some 18,000 miles. The Force Commander is Air Cdre T. O. Prickett, SASO at No 1 Group, Bomber Command.

Nine Miles High

DURING the recent Bomber Command bombing and navigational competition, to which brief reference was made on May 13, over 200 attacks were carried out by crews flying at near sonic speeds and over nine miles high using simulated radar bombing techniques. It is stated that precision was such that 95 per cent of the raids would have achieved total destruction of the targets—all of them precise pinpoints, for example the northwest corner of a factory and the ticket office of a tiny railway station—and the remaining 5 per cent would have inflicted crippling damage. More crews than ever before took part in this year's competition, and despite the increase in numbers, all took off on time and there were no early returns or abortive sorties. As reported last week, the USAF entry won the bombing with (to quote Air Ministry) "an exceptionally high standard never before achieved on either side of the Atlantic"; and in the navigation competition, where crews flew through jet streams and high-altitude turbulence over the Atlantic by astro-navigation, RAF crews filled the first 13 places.

Joint Ceremony

TWO fighter squadrons, Nos 64 (all-weather) and 65 (day), are to receive standards in a joint ceremony at RAF Duxford on July 6. The presentations are being made by Marshal of the RAF Sir William Dickson, Chief of the Defence Staff until his retirement last year and CAS from 1953 to 1955; and a cordial invitation to attend is extended to former members of both squadrons. Those wishing to do so should write to the Officer Commanding, RAF Duxford, Cambs.

The two squadrons have been closely associated since 1946, when they were based at Horsham St Faith, and they moved to Duxford within a year of each other. No 65 is the senior by a month, having been originally formed in July, 1916. During the war it was equipped with Spitfires, and by September 1940 its pilots had destroyed 40 enemy aircraft.

No 64 had Blenheims at the outbreak of the Second World War but later operated with Spitfires (claiming 40 enemy aircraft in the Battle of Britain) and Mustangs. In 1946 it was chosen as the proving squadron for D.H. Hornets.

The CO of No 65 Sqn is Sqn Ldr C. G. Maughan, who last year won the London to Paris race, and No 64 is commanded by Sqn Ldr H. J. C. Barnes.

Encouraging Character-building

FIVE Air Training Corps cadets, six former RAF boy entrants and two aircraft apprentices were among those who received Gold Awards under the Duke of Edinburgh's Award Scheme at Buckingham Palace last week. The presentation was made by His Royal Highness.

This brought the total of winners of the award to 39 since the scheme was instituted in 1956, and the total of gold, silver and bronze standard badges awarded to young members of the RAF and ATC to 624. The scheme is not a competition, but an expression of its sponsor's belief that all young people should have the fullest opportunities and encouragement to make the best use of their leisure by taking part in activities both satisfying and character-building.

Studying Tolerance Limits

AMONG the specialists from the RAF Institute of Aviation Medicine at Farnborough attending this year's congress of the Air-Space Medical Association at Miami, Fla, USA, was Sqn Ldr David I. Fryer, who read a paper on experiments carried out by the Institute over the past year into the effects of wind blast in order to study the limits of tolerance of an unprotected human body ejected from an aircraft at high speeds.

There have been 58 of these experiments, carried out in water on the large rotating beam at the Admiralty's Research Laboratory at Teddington. Sqn Ldr Fryer and R. W. J. Needham, a civilian employed at the laboratory, have acted as "guinea pigs" in the experiments—assisted by RN divers and the laboratory staff—and have achieved a speed of 20kt through the water. This is the equivalent of 515kt through the air, for to produce comparative conditions a man needs to travel in water at only 1-28th the speed he would travel in the air; at this speed, pressure on the front of the body is approximately 1,000lb/sq ft. During the experiments, physiological data recorded the effects upon the men's bodies, and the loads on their arms and legs were measured. This is believed to be the first time water has been used to test a man's tolerance to high speeds in the air, and the first time man has ever subjected himself to such tests submerged and at such high speeds—probably the highest ever recorded under water by an unprotected human body.

Sir Edward Appleton Trophy

AT a luncheon given by the University of Edinburgh on the occasion of the recent inspection of its University Air Squadron by AVM J. F. Hobler, AOC No 25 Group, Sir Edward V. Appleton, Principal and Vice-Chancellor of the University, presented a trophy given by himself and the Military Education Committee of the University. The award, to be known as the Sir Edward Appleton Trophy, was received on behalf of the squadron by AVM Hobler; it is a silver replica of a Chipmunk and will be awarded annually to the cadet obtaining the highest marks in the preliminary flying badge examination.

The commanding officer (Sqn Ldr G. C. Doak) and other members of the squadron have expressed themselves as being "greatly honoured by this gesture . . ., as such a presentation indicates not only the bond between University and Air Squadron but in future years will mark this occasion as part of the history of Edinburgh University."

IN BRIEF

RAF Fighter Command are presenting a missile-age version of the Battle of Britain at this year's Royal Tournament, which is being held at Earls Court, London, from June 22 to July 9.

Durham, Glasgow and Manchester UAS teams are competing for the Hack Trophy at Little Rissington tomorrow (May 28) with the winner of the Cooper Trophy, which is to be flown off first.

Two roads on a new housing estate at Wallingford in Berkshire have been named after Fg Off J. A. Wilding and Flt Sgt J. F. Andrew, who in September 1944 as pilot and flight engineer of a crippled Halifax stayed with their aircraft to prevent it crashing on the town. The mayor, Ald C. Atwell, unveiled a memorial plaque last Saturday at the junction of the two roads.

Two Gloster Meteor FR.9s of the Arabian Peninsula Reconnaissance Flight, based at Khormaksar, flying over the interior of the Western Aden Protectorate